DRILLING
Contractors and Equipment
Number

L AND GAS JURNAL

Are you Discarding Salvageable Drill Pipe?

In these days of drill pipe shortages, it may pay you to take a second and third look before discarding your pipe.

Many operators are now making hole with pipe reclaimed from castoff strings through the use of HUGHES Flash-Weld Tool Joints. These joints eliminate threaded pipe connections and make it possible to incorporate many different types of pipe in a single string. As a result, drill pipe that otherwise would not be used, is now being salvaged.

Regardless of pipe end design, any good drill pipe—with sufficient upset—can be converted into a uniform, dependable drill stem by using HUGHES Flash-Weld Joints.

Ask your HUGHES representative about the cost of unitizing your drill pipe remnants with HUGHES Flash-Weld Tool Joints, the tool joints with the proven performance record!

PRICE 50 CENTS TABLE OF CONTENTS PAGE 159 **SEPTEMBER 20, 1951**

You use hard-faced rock bits

for endurance...

MERCHROME-COATED PLUG VALVE
(BEFORE MACHINING)

then *also* use hard-faced Mud Valves

for *greater* endurance

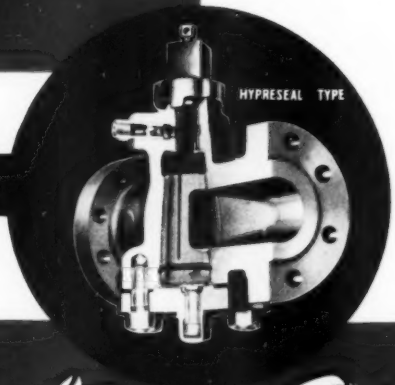
You know by experience that any rock bit lasts far longer when *hard-faced*. So it is with mud line valves. Nordstrom Merchrome coated mud line valves are hard-faced to file-hardness. Then the plug and body seat are ground to precision fit and lapped. The seat is *never* exposed. Automatic lubrication with Hypermatic further insures against abrasion and leakage. The ports are pressure-sealed with energized lubricant.

Abrasion is barred from getting a start. Merchrome coating adds tens of thousands of feet in extra drilling life to your valves. The cost of a Nordstrom mud line valve is a fraction of usual cost if you figure the amount of hole drilled per valve.

— *now automatically lubricated with*

Hypermatic

MERCHROME-COATED . . .



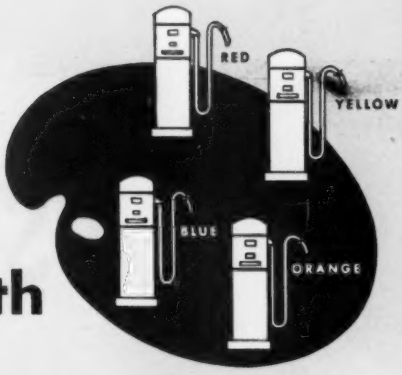
Nordstrom Valves

ROCKWELL MANUFACTURING COMPANY

400 North Lexington Avenue • Pittsburgh 8, Pennsylvania

Atlanta, Boston, Chicago, Columbus, Houston, Kansas City, Los Angeles, New York, Philadelphia, San Francisco, Seattle, Tulsa
and leading Supply Houses in Export. Rockwell Manufacturing Co. International Sales Division, 2011 Empire State Building, New York 1, N. Y.

Assure uniform gasoline colors with readily soluble Du Pont Dyes



TELLING A STORY IN COLOR, this recording spectrophotometer measures the strength, shade and brightness of colors obtained with Du Pont Gasoline Dyes. To assure refiners of uniform tinctorial properties, Du Pont Gasoline Dyes are carefully checked by instruments like this.

THE COMPLETE LINE of Du Pont Gasoline Dyes includes red, blue, yellow and orange. These can be used individually, or mixed in combination to obtain virtually any desired color or shade.

THE UNIFORMITY of your own distinctive coloring is assured by the excellent solubility and high tinctorial strength of Du Pont Dyes.

FOR ADDED EFFICIENCY in your dyeing operation, one of the five conveniently located Du Pont District Laboratories will be glad to recommend the mixture and quantity of the dyes needed to obtain the colors you desire. They will also work with your own laboratory on other additive problems.

FOR FREE SAMPLES, get in touch with your nearest Du Pont District Office.

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STAND OUT

..because it stands up!

Check the advantages of Fairbanks-Morse General Purpose Motors and you'll see why they deliver *stand out* performance . . . *stand up* under the heavy starting loads and long period peak capacity operation of oil field service.

Take the exclusive, one-piece Copperspun Rotor for example and note these advantages:

- ★ A truly one-piece indestructible copper rotor winding.
- ★ Withstands higher temperatures: (melting point 2,000° F. for Copper, 1,100° F. for Aluminum).
- ★ High electrical and thermal conductivity.
- ★ Dense, uniform grain structure.
- ★ Separately mounted fans: permitting complete overall machining, better quality control, better dynamic balance.

Then consider the unique one-piece cast frame that protects the motor against falling particles and dripping liquids in *any position* . . . the cross-flow ventilation that assures uniform, cool operating temperatures and the many other advantages your supply store will be happy to demonstrate. Easy to see why Fairbanks-Morse should be your choice for *stand out* motor service. Fairbanks, Morse & Co., Chicago 5, Illinois.

FAIRBANKS-MORSE,

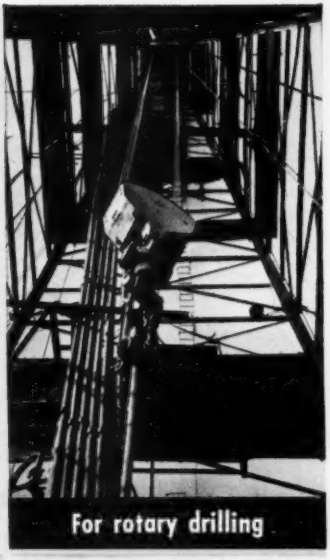
a name worth remembering

OIL FIELD EQUIPMENT • PUMPS • SCALES
ELECTRIC MOTORS • GENERATORS • LIGHT PLANTS • DIESEL, DUAL FUEL AND GASOLINE ENGINES • MAGNETOS

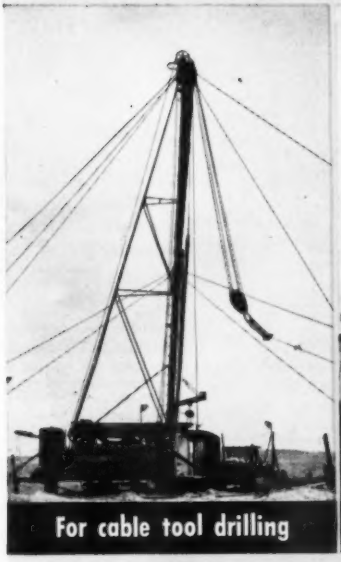
For better service and more economy

Order from a thousand and one

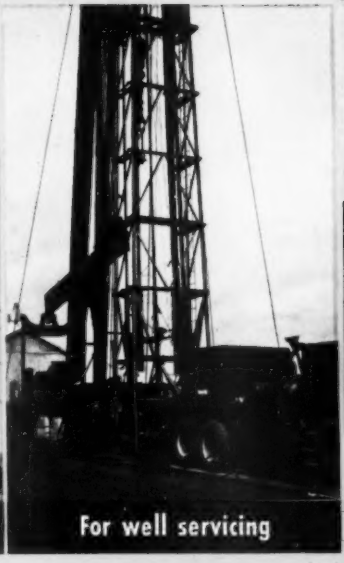
MACWHYTE WIRE ROPES



For rotary drilling



For cable tool drilling



For well servicing

For pipe lines

You'll get maximum service from wire rope that has been specially designed for a special job. Over the years, ropes for all types of equipment in every field have been developed by Macwhyte. It will pay you to get Macwhyte Wire Rope that has been job-proved and engineered for your particular equipment. Recommendations are promptly available from Macwhyte distributors or Macwhyte Company.

MACWHYTE COMPANY, *2916 Fourteenth Avenue, Kenosha, Wisconsin. Manufacturers of Monarch Whyte Strand PREformed, Internally Lubricated Wire Rope, Atlas Braided Wire Rope Slings, Aircraft Cables and Assemblies, Monel Metal and Stainless Steel Wire Rope. Mill Depots: New York • Pittsburgh • Chicago • Minneapolis • Fort Worth • Portland • Seattle • San Francisco • Los Angeles. Catalog on request.*

Here's the rig you asked for–

Easy to operate... Fast... Economical for 6,000 to 10,000-foot work

The New "Oilwell" NO. 76

IT'S LIGHT IN WEIGHT

... with capacities far beyond most rigs of comparable size and weight.

IT'S EASY TO MOVE

... either with the compound or disconnected from it.

IT'S COMPACT

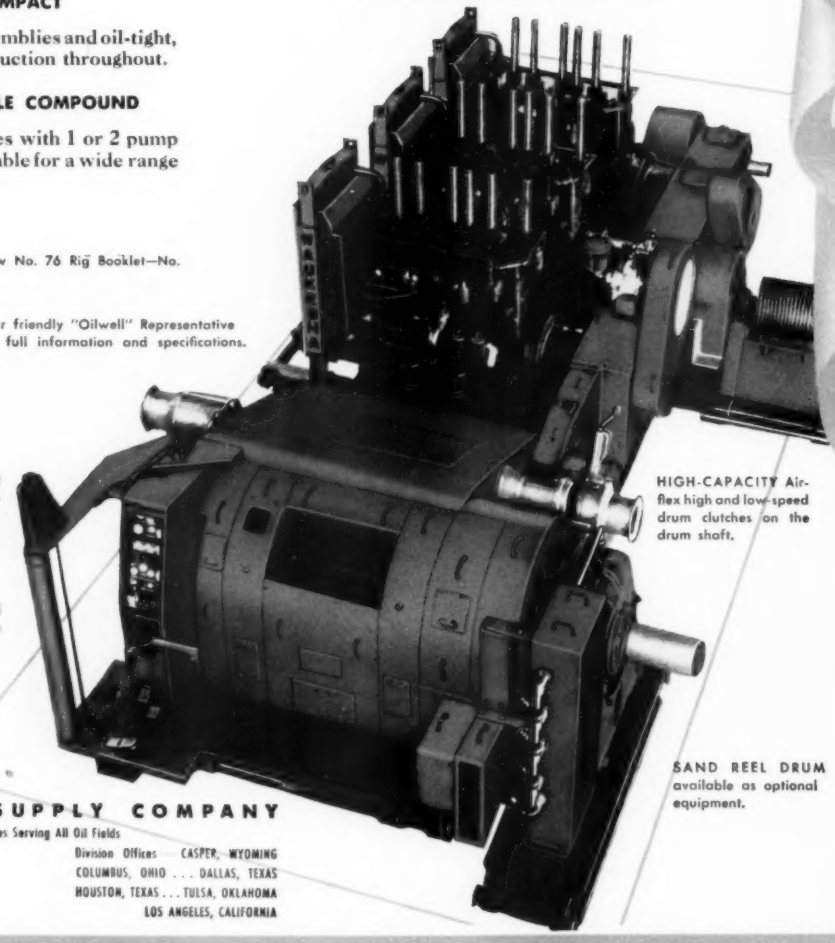
... with unitized assemblies and oil-tight, weatherproof construction throughout.

HIGHLY FLEXIBLE COMPOUND

... for 2 or 3 engines with 1 or 2 pump drives, makes it suitable for a wide range of applications.

... WRITE for our new No. 76 Rig Booklet—No. 2-51.

... OR ASK your friendly "Oilwell" Representative for full information and specifications.



BRAKE FLANGES are water cooled by a fully enclosed water circulating system.

ALL CONTROLS centrally located in a compact control panel which can be closed when moving.

HIGH-CAPACITY Airflex high and low-speed drum clutches on the drum shaft.

SAND REEL DRUM available as optional equipment.

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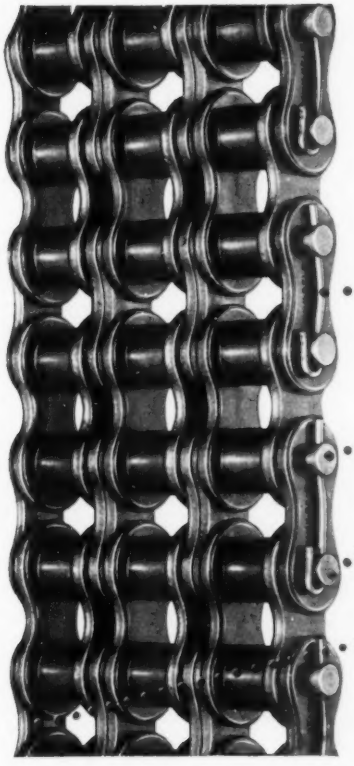
UNITED STATES STEEL

3 simple steps for coupling and uncoupling LINK-BELT Roller Chain



Full advantage of E-Z Assembly feature of Link-Belt Precision Steel Roller Chain is gained if you follow these three easy steps for *uncoupling:*

1. Remove the Shepherd's Crook Cotter.

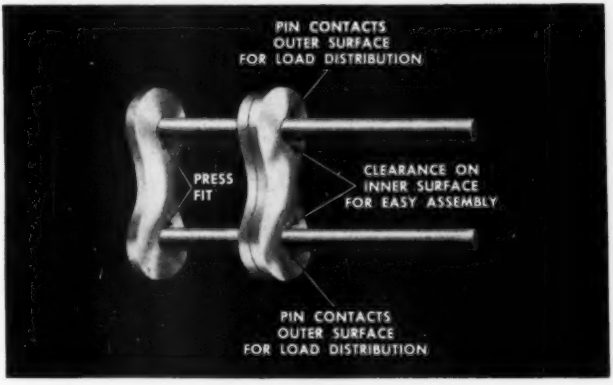
2. Alternately hammer the cotter end of the pins to free them from the press fit of the outside bar.

3. At this point, the E-Z Assembly provides easy removal of the pin link because of the modified construction of the middle bars. When the press fit is released, push the two pins (still held together by the side bar at other side of the chain) through the roller links and middle bars—and the chain is uncoupled.

To *couple* the chain, reverse the procedure making certain to use the side bar stamped "Link-Belt" only as an *outside bar*—not as a middle bar. This is necessary to maintain the advantage of the press fit in the outer bars.

E-Z Assembly Feature

Patented E-Z Assembly feature of Link-Belt Precision Steel Roller Chain has won world-wide approval. Coupling and uncoupling of multiple width chains—right on the job—is far easier. There's absolutely no sacrifice of load distribution . . . no loss of the chain's remarkable performance. Press-fits between chain pins and middle bars have been modified. But full load-carrying capacity across the entire width of the chain has been maintained.



LINK-BELT COMPANY: Indianapolis 6, Dallas 1, Houston 1, Kansas City 8, Mo., Los Angeles 33, New York 7, Toronto 8. Distributors in all fields. 12,538

LINK-BELT

PRECISION STEEL ROLLER CHAIN

The Oil and Gas Journal, published Thursdays by The Petroleum Publishing Company. Entered as second-class matter September 1, 1910, at post office at Tulsa, Okla., under act of March 3, 1879. U. S. and foreign rates to the petroleum industry, $3 yearly. Copyright 1951.

Fast worker—reliable, too! This "Caterpillar" Diesel No. 12 Motor Grader, owned by Younger Construction Co., Inc., is leveling location of finished oil well on No. 53 Texas Co. P. L. Fuller lease in Scurry County, Texas. An essential tool in the fields, it stands up under tough going. As a military tool, it's essential for airport construction and maintenance, road construction, establishment of bases and scores of other earthmoving jobs.

HOW TO GET MORE WORK FROM YOUR "CAT" MOTOR GRADER!

Our country's defense needs have increased the demand for oil and petroleum products. The pressure is on for faster production, faster transportation. One of the tools that steps up the pace is the "Caterpillar" Motor Grader, which helps by building and maintaining haul roads, making well settings, building locations.

The speed, versatility and big work capacity that have made this machine essential in the oil fields have also made it essential to our armed forces. As military orders get first call, you may not be able to obtain prompt delivery of new machines. So it will pay you to plan now to get more work from your present equipment.

"Cat" Motor Graders are ruggedly built for long life. But good care on your part can lengthen that life span by thousands of extra service hours. Here's how:

1. **Follow the recommended *operating* care in your Operator's Instruction Book. Read and reread it.**
2. **Observe the *maintenance* suggestions in the Operator's Instruction Book. They're down-to-earth—experience has proved them practical and effective.**
3. **Anticipate your future replacement parts needs by seeing your "Caterpillar" dealer about them *now*. Don't wait until wear gets beyond repair—many a part can be rebuilt *if* serviced in time.**

You're in good hands when you work closely with your "Caterpillar" dealer. He is anxious to help you solve your problems. His service staff, service trucks and service facilities are ready to help you lick them.

CATERPILLAR TRACTOR CO. • PEORIA, ILLINOIS

You're the Doctor

Preventive maintenance is good medicine for long life. Your Operator's Instruction Book is invaluable in the fight to conserve machine life. Follow the operation, lubrication and maintenance recommendations. When wear is evidenced in cutting edges, gears, tires or engine, see your "Caterpillar" dealer. He can help you prolong the life of your motor grader. Your motor grader is essential—don't abuse it.

CATERPILLAR

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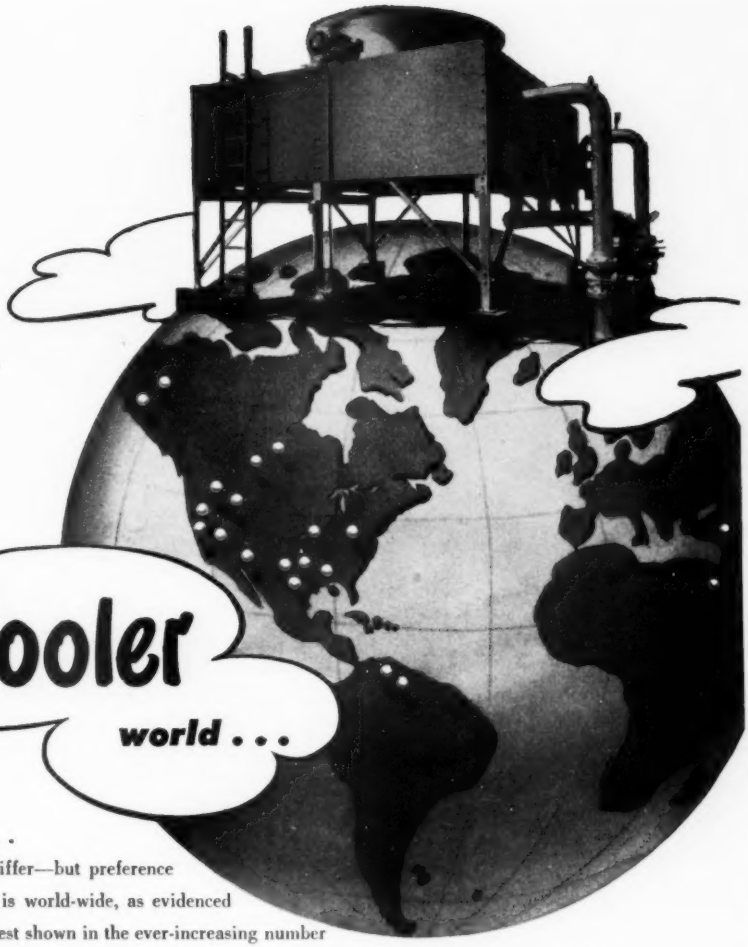
DIESEL ENGINES • TRACTORS • MOTOR GRADERS • EARTHMOVING EQUIPMENT

from Arizona to Arabia



it's a DriCooler world . . .

Climates vary . . . cooling requirements differ—but preference for Marley DriCoolers is world-wide, as evidenced by the exceptional interest shown in the ever-increasing number of DriCooler installations throughout the world. Consider all factors — weather conditions, fluid to be cooled, horsepower required, influence of corrosion, and many more — and you'll find that Marley offers you the best, most economical dry cooler for your specific job.

This is so because Marley makes a *complete* line of DriCoolers in a wide range of capacities and designs; because each Marley DriCooler is *engineered for the job*, whether it be to cool jacket water in the Arctic or lube oils in the burning desert.

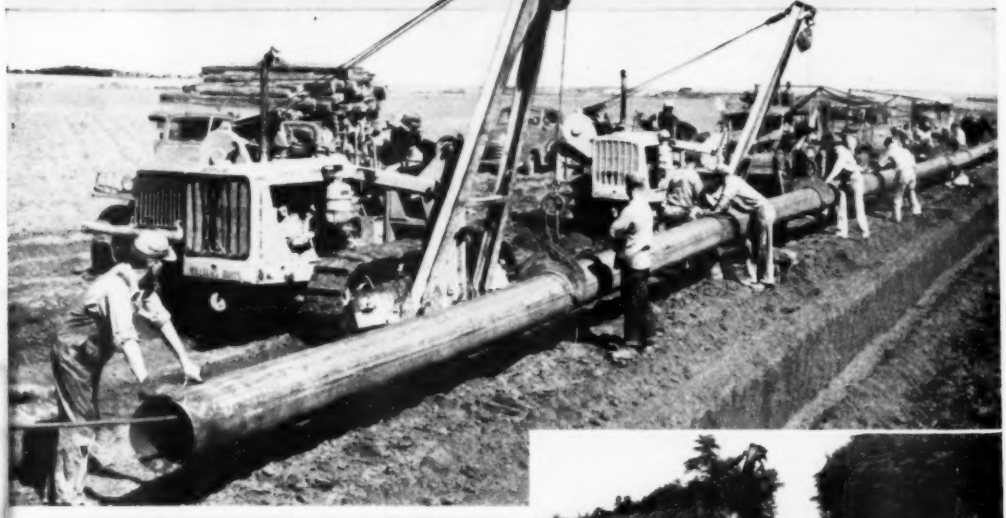
There's a Marley application engineer in every major city, whose services and experience are yours for the asking. Call your Marley man for full details or write for Bulletin DC-50.

Also producers of
AQUATOWERS
VAIRFLO TOWERS
DOUBLE-FLOW TOWERS
NATURAL DRAFT TOWERS
SPRAY NOZZLES

MARLEY

The Marley Company, Inc.
KANSAS CITY 15, KANSAS

FROM START TO FINISH—



IT'S TRACKSON ALL THE WAY

From clearing to backfilling, TRACKSON TRACTOR EQUIPMENT sets the pace for the Pipe Line job. On any size pipeline, Trackson PIPE LAYERS, ANGLEFILLERS, TRAXCAVATORS and other Tractor Equipment prove their money-making, time-saving efficiency, as they take the rough country and tough jobs in stride.

Powered by dependable, matching "Caterpillar" Diesel Tractors, Trackson PIPE LAYERS have the lifting power, speed and control for safe, fast pipe handling . . . from stringing to lowering-in. Add an ANGLEFILLER to the PIPE LAYER for grading, leveling and backfilling work.

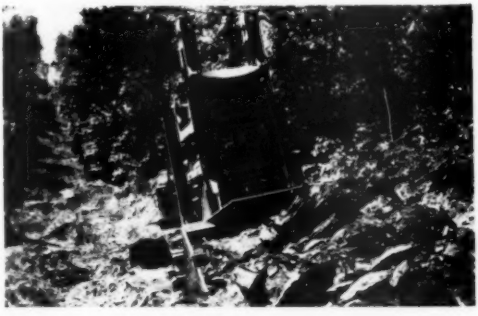
TRAXCAVATORS (available in five sizes with bucket capacities from ½ to 4 cubic yards) dig, load, grade, backfill and cut right-of-ways . . . speed up clearing, excavating and other earth moving chores.

Your TRACKSON-CATERPILLAR Dealer offers the best in parts and service facilities wherever the line may take you. See him for complete information on how this sturdy equipment can help you. Or write TRACKSON COMPANY, Dept. OG-91, Milwaukee 1, Wisconsin.

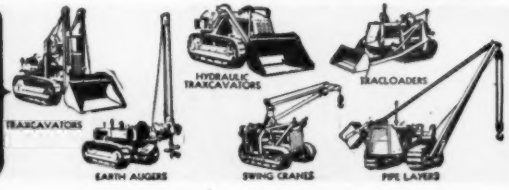
Top: East of Regina, Saskatchewan, two MD6 PIPE LAYERS on tie-in.

Above: Pipe stringing near Draper, N. C.

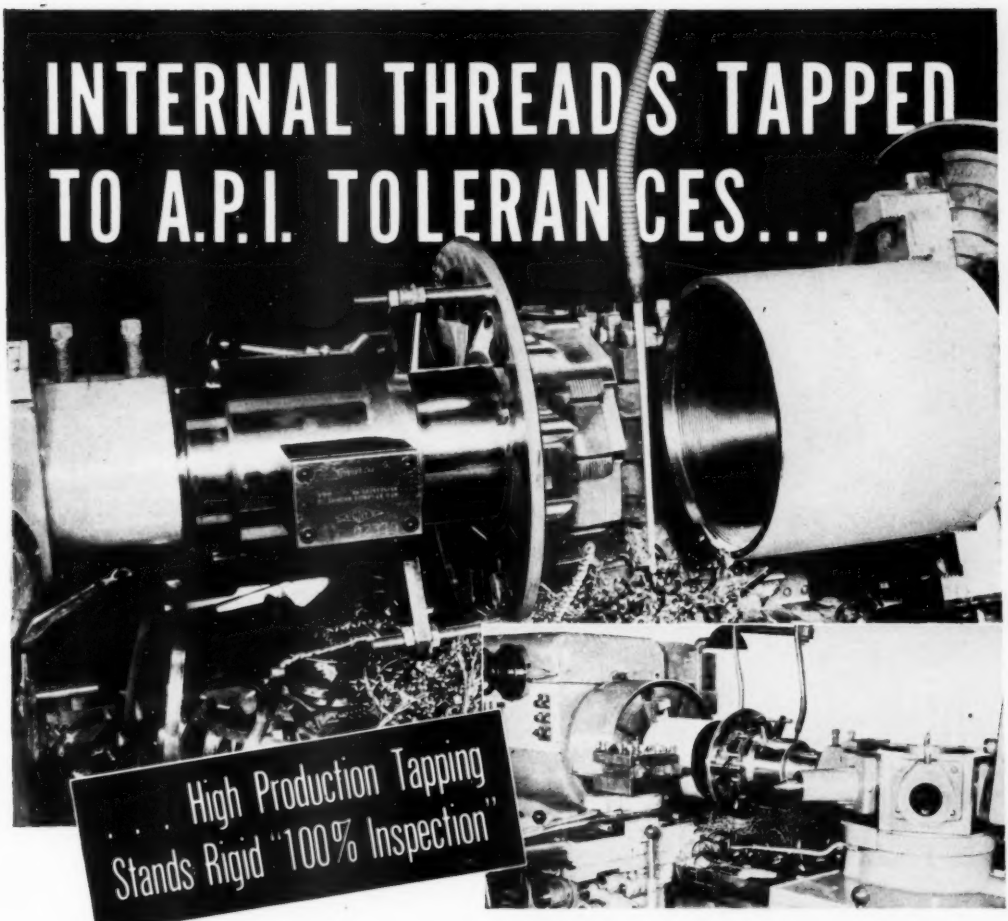
Below: Big TRAXCAVATOR clears right-of-way through shale.



TRACKSON
TRACTOR EQUIPMENT



INTERNAL THREADS TAPPED TO A.P.I. TOLERANCES...



. . . High Production Tapping Stands Rigid "100% Inspection"

Casing couplings are subjected to enormous strains created by the weight of the suspended casing, as well as to tremendous internal and external pressures. For these reasons they require threads of extreme accuracy. Thus the prime consideration in the selection of equipment for the production of these threads is that it produce A.P.I. threads at economical production rates.

The operation shown here is one of many where internal tapered threads are cut to A.P.I. tolerances at high production rates by Landis LL Receding Collapsible Taps. 8 pitch round form threads are cut in Grade N80 casing couplings 10¾" in diameter to a length of 4" with a ¾" taper. Production is high—averaging consistently about 17 surface feet per minute. A.P.I. tolerances are met without difficulty.

Landis LL Receding Collapsible Taps are designed and built for this type of work. The receding mechanism causes the chasers to recede into the tap head automatically at a rate equal to the taper of the thread being cut. When the thread is completed the chasers collapse into the tap head, and the tap is withdrawn.

Each tap has a wide range of cutting diameters since the tap heads are detachable and interchangeable. For example, if furnished with appropriate heads, the 6LL Tap Body, shown here equipped with a 10" ALM Tap Head will cut threads in all pipe sizes ranging from 6" to 12" inclusive. The Style LL Tap Body is made in four sizes to cover a range of nominal pipe sizes from 1" to 12" inclusive.

Write for Bulletin G-95

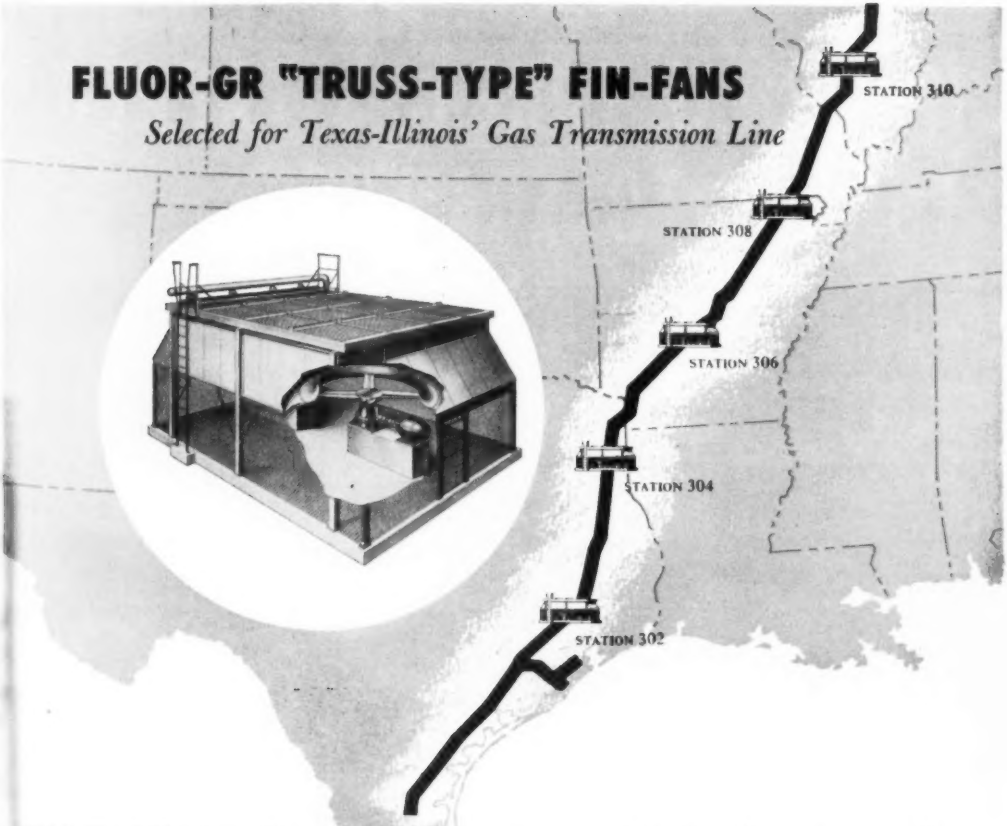
LANDIS STYLE LL RECEDING COLLAPSIBLE TAP

LANDIS *Machine* COMPANY · WAYNESBORO PENNSYLVANIA

Represented in the Domestic Oil Fields by: Colcord-Wright Machinery & Supply Co., St. Louis, Mo.; C. J. Harter Machinery, Houston, Texas; Frederic-Baker Co., New Orleans, La.; Moore Machinery Co., Los Angeles and San Francisco, Calif.; Hendrie & Bolthoff Mfg. & Supply Co., Denver, Colo.

FLUOR-GR "TRUSS-TYPE" FIN-FANS

Selected for Texas-Illinois' Gas Transmission Line

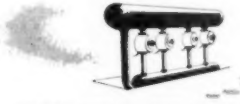


FIN-FANS *handle all jacket water and lube oil water cooling*

The initial five stations on the Texas-Illinois Natural Gas Pipeline Company's 1200-mile, 30-inch gas transmission line are equipped with Fluor's new "Truss-Type" Air-Cooled Heat Exchangers. In addition to economy and dependability of operation, these new "Truss-Type" Fin-Fans are designed for low-cost extension by utilizing end columns of existing units as an integral part of future extensions. When greater cooling capacity is desired, it is only necessary to add to the existing installation—time and space requirements are minimized and the extension can be made without disturbing plant operation.

This new Texas-Illinois line is another major gas transmission system to select Fluor-GR Air-Cooled Heat Exchanger Equipment for compressor station jacket water and lube oil water cooling service. The Fluor Corporation, Ltd., and The Griscom-Russell Company pioneered the use of air-cooled heat exchangers in gas transmission, and remain the leaders in the design and fabrication of such equipment for the cooling of liquids and gases and the condensing of vapors.

The accumulated experience of both Fluor and Griscom-Russell is available to you for your present and future heat transfer problems by contacting any Fluor office. In the meantime, why not send for Fluor Bulletin No. FF 8501 for your files?



FLUOR PULSATION DAMPENERS INSTALLED FOR BOTH SUCTION AND DISCHARGE

To reduce gas stream pulsations and attendant vibration, Fluor Pulsation Dampeners are installed for both suction and discharge service in four of the five Texas-Illinois Natural Gas Pipeline Company's compressor stations.

Design of the Fluor Dampeners is such that at least 85% of all offending pulsations in the gas streams will be smoothed out—insurance for higher operating efficiency, improved flow measurement, lower pipe maintenance costs, and a better safety record.

BE SURE WITH FLUOR

FLUOR

MANUFACTURERS of Pulsation Dampeners, Cooling Towers, Fin-Fan Units, Gas Cleaners and Mufflers.
DESIGNERS AND CONSTRUCTORS of Refining, Natural Gas and Chemical Processing Plants.

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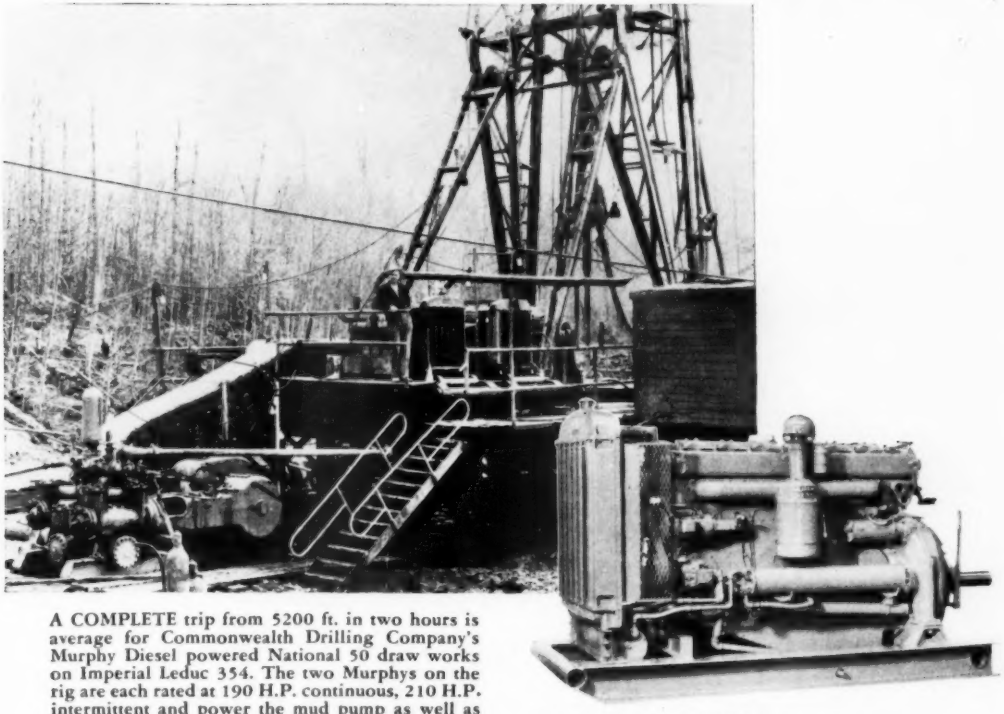
New York, Chicago, Pittsburgh, Boston, Tulsa, Houston, San Francisco, Birmingham and Calgary.

REPRESENTED IN THE STERLING AREAS BY: Head Wrightson Processes Ltd., Teesdale House, Baltic Street, London, E.C.1., England

Steady, dependable MURPHY DIESEL POWER

means good drilling

for Commonwealth Drilling Co. of Canada



A COMPLETE trip from 5200 ft. in two hours is average for Commonwealth Drilling Company's Murphy Diesel powered National 50 draw works on Imperial Leduc 354. The two Murphys on the rig are each rated at 190 H.P. continuous, 210 H.P. intermittent and power the mud pump as well as the draw works. 6¾" liners and 4½" drill pipe are used for the complete hole. Art Wilderman, Tool Pusher, says the Murphys give him good, steady, reliable power . . . just the kind of power you need for good drilling.

There's a good reason for Murphy Diesel's reliability . . . it's the advanced design and rugged construction, unmatched by any other engine of comparable size. In addition, you get more power from a gallon of fuel, starting is easier under all conditions, performance is smoother and more responsive.

Full details are given in the informative booklet "10 Questions to Ask a Diesel Engine Salesman". Ask your Murphy Diesel Dealer . . . or write direct for your copy.

MURPHY DIESEL COMPANY, 5305 W. Burnham St., • Milwaukee 14, Wisconsin

MURPHY DIESEL

***Heavy Duty Power* For The Oilfields**

Murphy Diesel Engines and Power Units for drilling and pipe line pumping, 90 to 226 H.P., 1200 and 1400 RPM. Generator Sets, 60 to 140 K.W. Dual-Fuel Engines, 135 to 180 H.P. Also Crude Oil Burning Engines.

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See your Murphy Diesel Dealer

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GREAT BEND, KANSAS
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HOUSTON, TEXAS Houston Engine & Pump Co., Inc.

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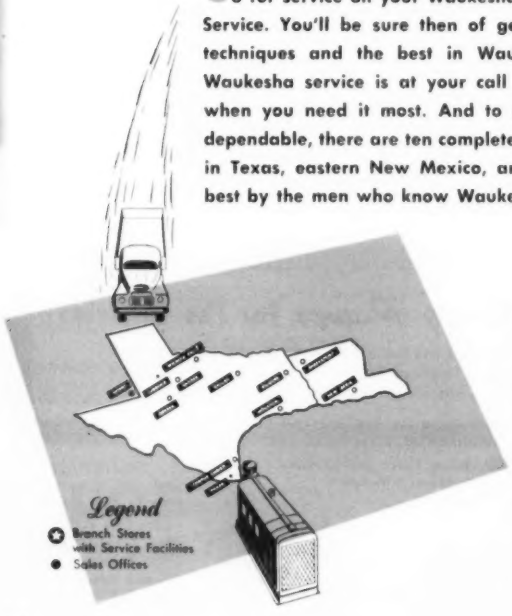
LOS ANGELES, CALIF.
Engine Sales & Service

YOU'RE TREATED BEST AT HOME

YOUR *Waukesha* ENGINE IS TREATED BEST AT HOME, TOO

So for service on your Waukesha Engine call Waukesha Sales and Service. You'll be sure then of getting the latest in factory-service techniques and the best in Waukesha factory-trained mechanics. Waukesha service is at your call twenty-four hours a day to help when you need it most. And to make Waukesha service fast and dependable, there are ten complete service shops strategically located in Texas, eastern New Mexico, and Louisiana. You will be treated best by the men who know Waukesha best.



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SALES & SERVICE, INC.

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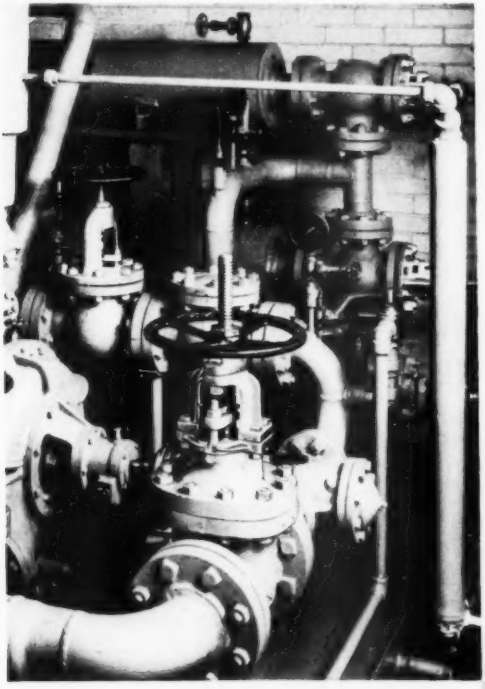
EXCLUSIVE DISTRIBUTORS FOR WAUKESHA PRODUCTS IN TEXAS, LOUISIANA AND EASTERN NEW MEXICO

Where Power and Heat protect the helpless...

Buffalo State Hospital relies on Jenkins Valves

Architects: YORK & SAWYER, NEW YORK
General Contractor: THE JOHN W. COWPER CO., INC., BUFFALO, N. Y.
Plumbing Contractor: GEO. H. DRAKE, INC., BUFFALO, N. Y.
Heating Contractor: QUACKENBUSH CO., INC., BUFFALO, N. Y.



Among the 1100 Jenkins Valves in the new Power House at the Buffalo, N. Y., State Hospital are these in the prefabricated pump heater set. More than 875 others control steam, water, fire, air conditioning and other vital pipelines in the new Medical and Surgical Building.

Serving a veritable "city of patients", the new power plant at this New York State Institution, one of the nation's largest, provides heat and power for many separate buildings. One building alone, the newly-completed Medical and Surgical unit, has 698 rooms.

In such a complex modern "plant" for the treatment and comfort of patients, power and heat must be supplied with unfaltering *efficiency.* On their performance record, Jenkins Valves were chosen.

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Jenkins builds *extra* endurance into valves — proved by low upkeep cost records in power plants both large and small. Yet, despite this *extra* value, *you pay no more* for Jenkins Valves. For new installations, for all replacements, let the Jenkins Diamond be your guide to lasting valve economy. Jenkins Bros., 100 Park Ave., New York 17. Jenkins Bros., Ltd., Montreal.

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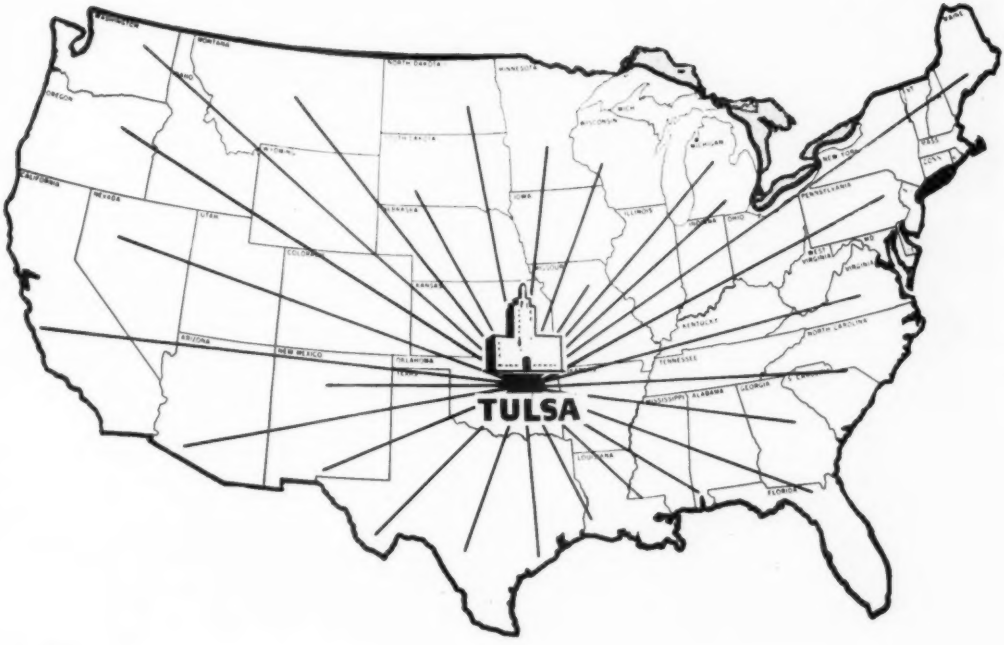

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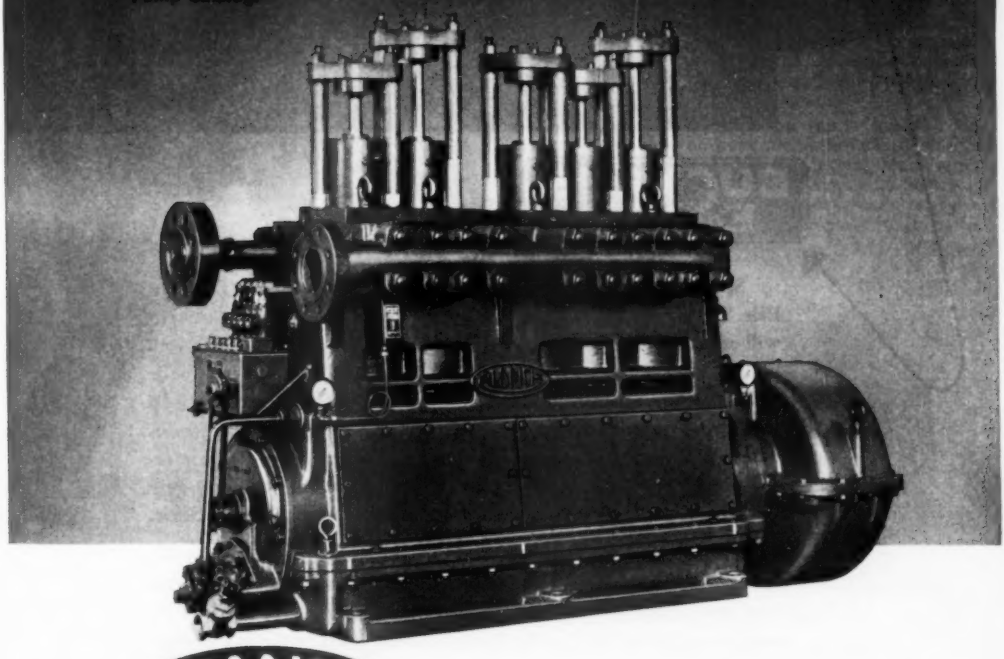
Today—to bring you files up-to-date—request the Aldrich Direct Flow Pump Catalog.



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Let's go...let's get that SCRAP in!

All your SCRAP is urgently needed, NOW

THE scrap shortage is serious. *Your* scrap—every pound of iron and steel scrap you can locate in your plant or factory—is vitally needed and needed right away. For unless you do everything possible to get this scrap on its way to the mills, steel production is bound to slow up. That can't be allowed to happen. But without your help it surely will.

It takes at least one-half ton of scrap to make one ton of steel. With the mills turning out more than 2 million tons of steel per week, over 1400 carloads of industrial scrap are needed *every day*. And industry, somehow, must provide it.

What you can do to meet this emergency

First, organize a permanent Scrap Salvage Committee and make the "drive-for-scrap" part of your daily operations. Search out every possible source of scrap. Turn your old and worn-out equipment, tools and machinery over to your scrap dealer, at once. Dig out your discarded dies, rusted-out tanks and boilers, your old rails and other miscellaneous junk, and start them back to the mills through your scrap dealer. Encourage every employee to report every retired or obsolete machine that now stands idle—see that it is turned in for scrap.

By getting this "dormant" scrap off your premises and into the furnaces you'll be helping not only yourself but America as well. *More* scrap turned in, means *more* steel turned out—it's as simple as that. So let's get going.

You'll find your local scrap dealers listed in the yellow pages of the phone directory.

USS

1-1329

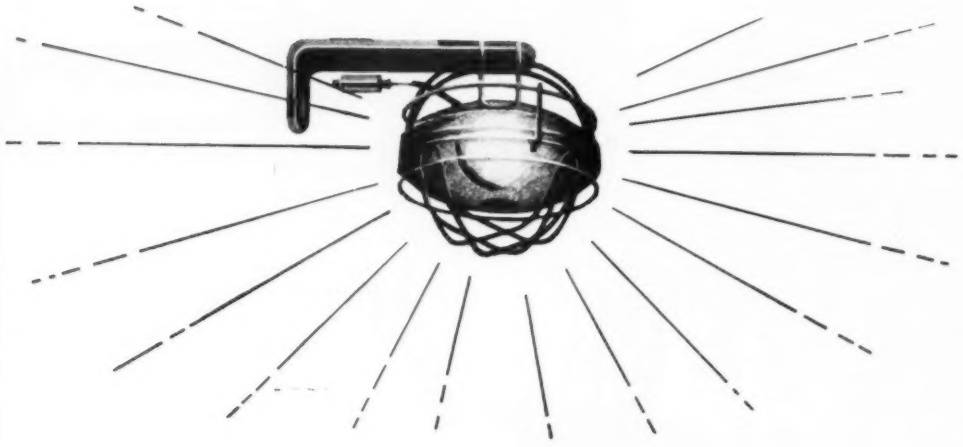
This page would ordinarily be used to tell you about

NATIONAL SEAMLESS
Drill Pipe, Casing and Tubing

but, because without SCRAP we cannot produce steel, we are asking instead for your all-out help in getting more SCRAP to the mills.

NATIONAL TUBE COMPANY, PITTSBURGH, PA.
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

UNITED STATES STEEL



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ARE you ready for fire *when* it strikes? Week ends? Nights? During shut downs? Put a Kidde Automatic Fire Extinguisher System on the job—it's *always* on the alert against fire.

The heat from a fire hits the Kidde detector . . . sends a signal that releases flame-smothering carbon dioxide automatically. Such a system can protect a single space . . . or many spaces throughout the plant.

Wherever a hazard exists—in engine rooms, fuel storage rooms, document vaults, electrical equipment—you can depend on fire-sensitive, fast-acting Kidde automatic or manual systems to protect your property. Call on us for full information.

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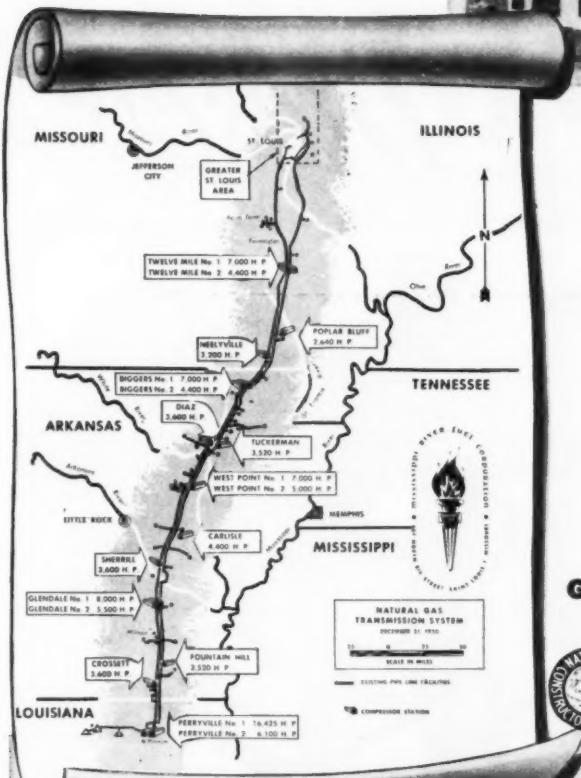
GRAVER CONSTRUCTION CO. HELPS MISSISSIPPI RIVER FUEL CORP. REACH DELIVERY CAPACITY GOAL



To add to its daily delivery capacity of natural gas, Mississippi River Fuel Corp. called on Graver Construction Co. to build four compressor stations last Fall. Complete new stations were built at Tuckerman, Carlisle and Fountain Hill, Ark. A former experimental station at Wilmar, Ark. was dismantled, moved and re-erected at Bonne Terre, Mo. These additional facilities were ready in time for the winter fuel season and enabled the company to reach its required goal.

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A DIVISION OF

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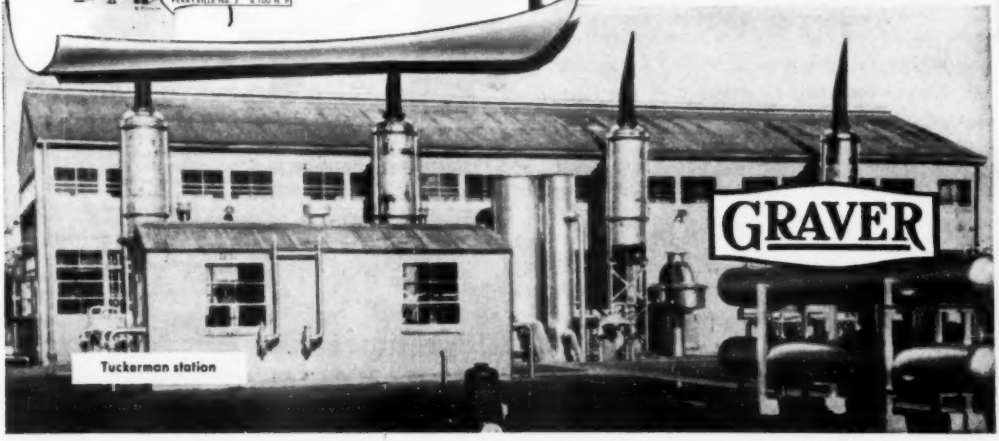
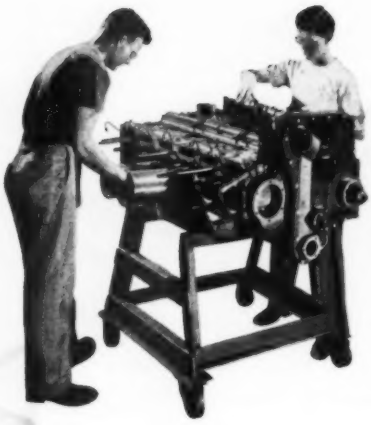


Tuckerman station



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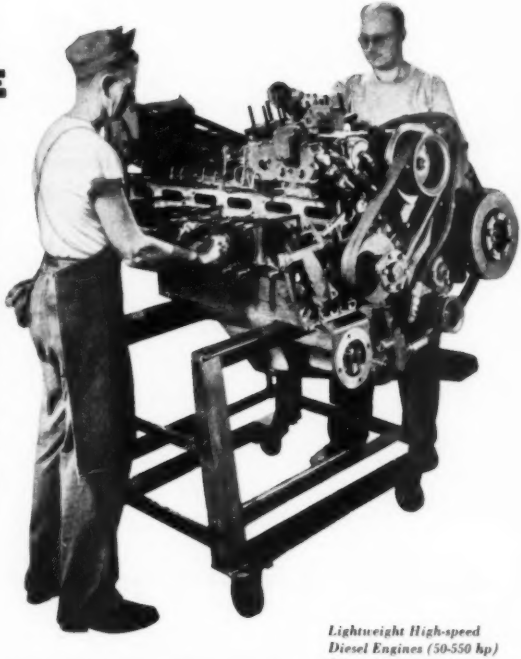
BUILT NOT ONCE BUT TWICE

You get more power and profits with Cummins Diesels. They're custom-built to fit your job, and your equipment. And they are literally built *not once but twice.* Each engine is assembled, run-in tested, disassembled . . . inspected, reassembled and *tested* again. Such precision building, Cummins exclusive fuel system, efficient service and parts organization . . . mean *less* "down-time" and *more* profitable power from every Cummins Diesel Engine. *See your Cummins dealer.*



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Export: CUMMINS DIESEL EXPORT CORPORATION Columbus, Indiana, U.S.A. • Cable: CUMDIEX

Lightweight High-speed Diesel Engines (50-550 hp)
for: on-highway trucks
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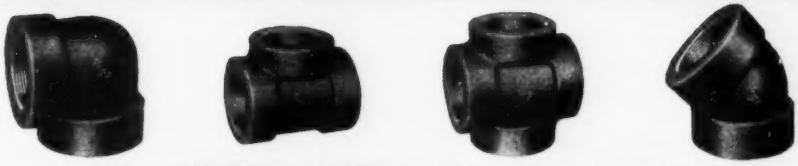
for Safety and Long-Time Service



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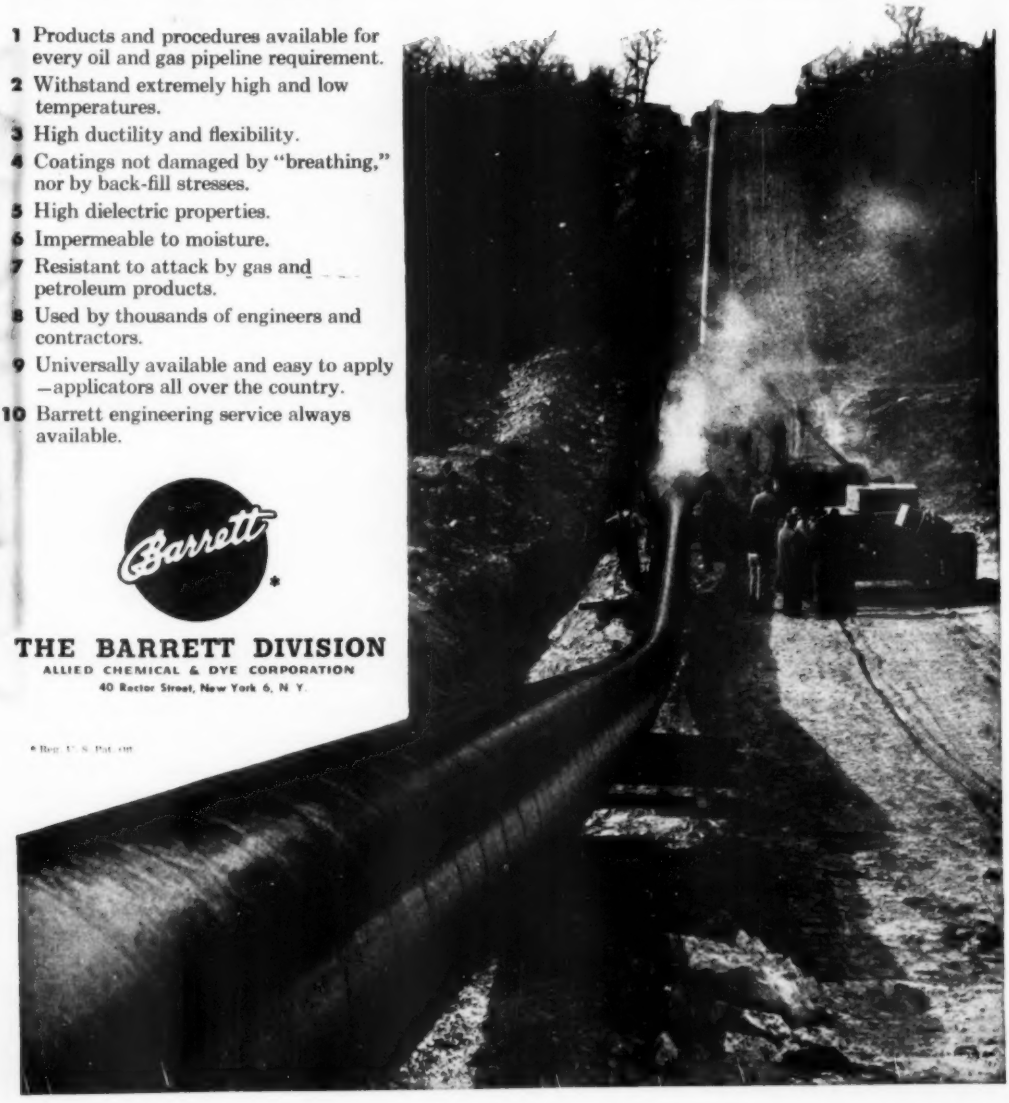

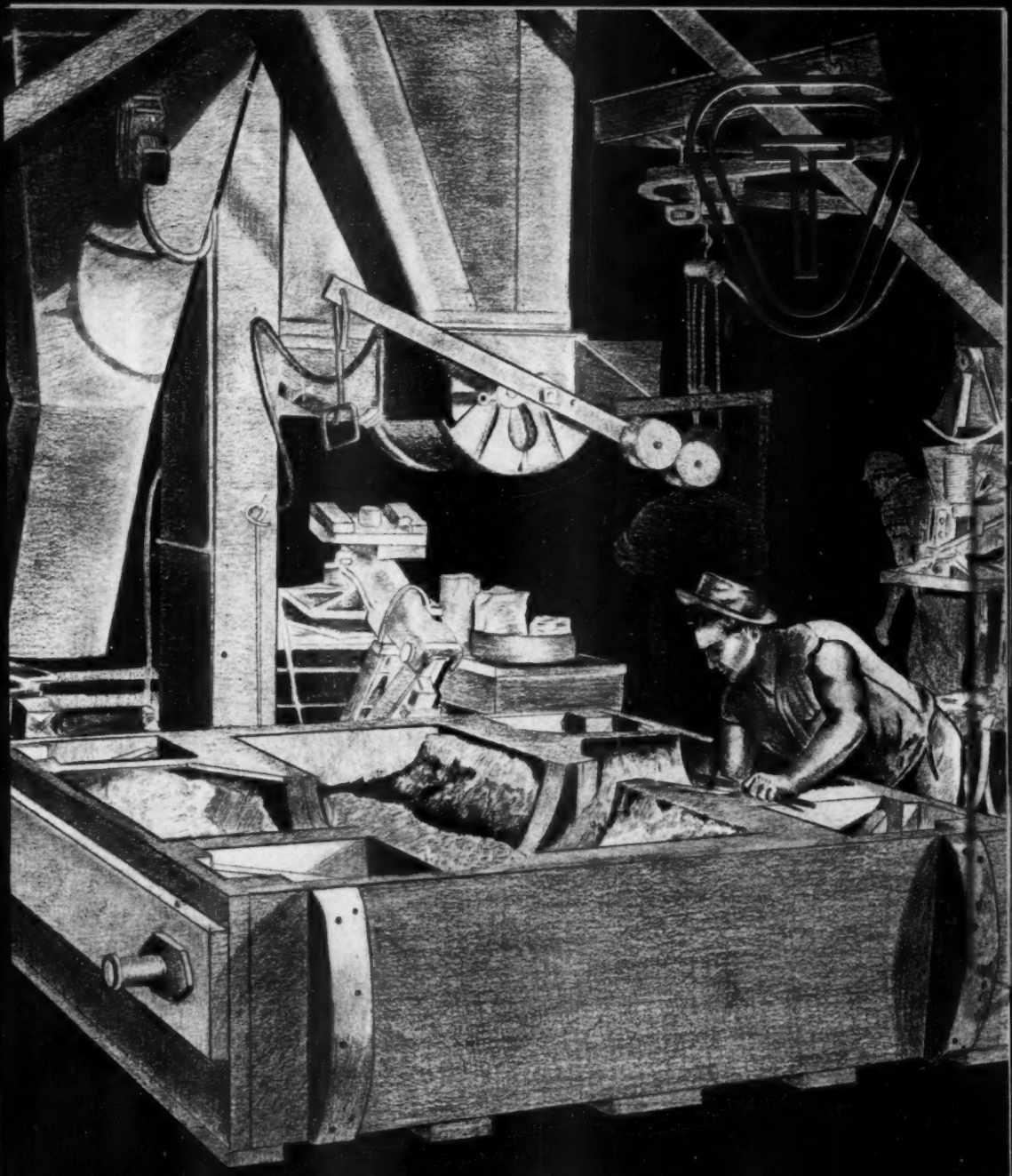

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80 YEARS OF PROGRESS WITH THE OIL INDUSTRY

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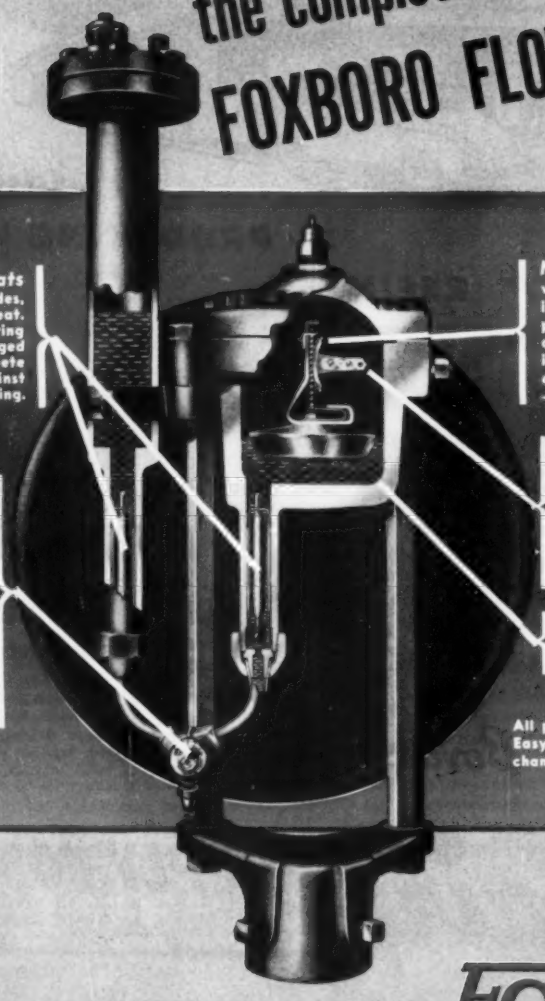
New Basic Advances in the complete line of FOXBORO FLOW METERS!



NEW Check Floats with redesigned guides, ball plug and seat. Insure perfect seating every time! Submerged in mercury for complete protection against frosting and fouling.

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NEW Segmental Drive Assembly with stainless steel ball chain that insures free travel of float, and with positive collet-type bearing shaft clamp. Assembly also available in Type 28 Meters with complete ambient temperature compensation —an exclusive new Foxboro feature.

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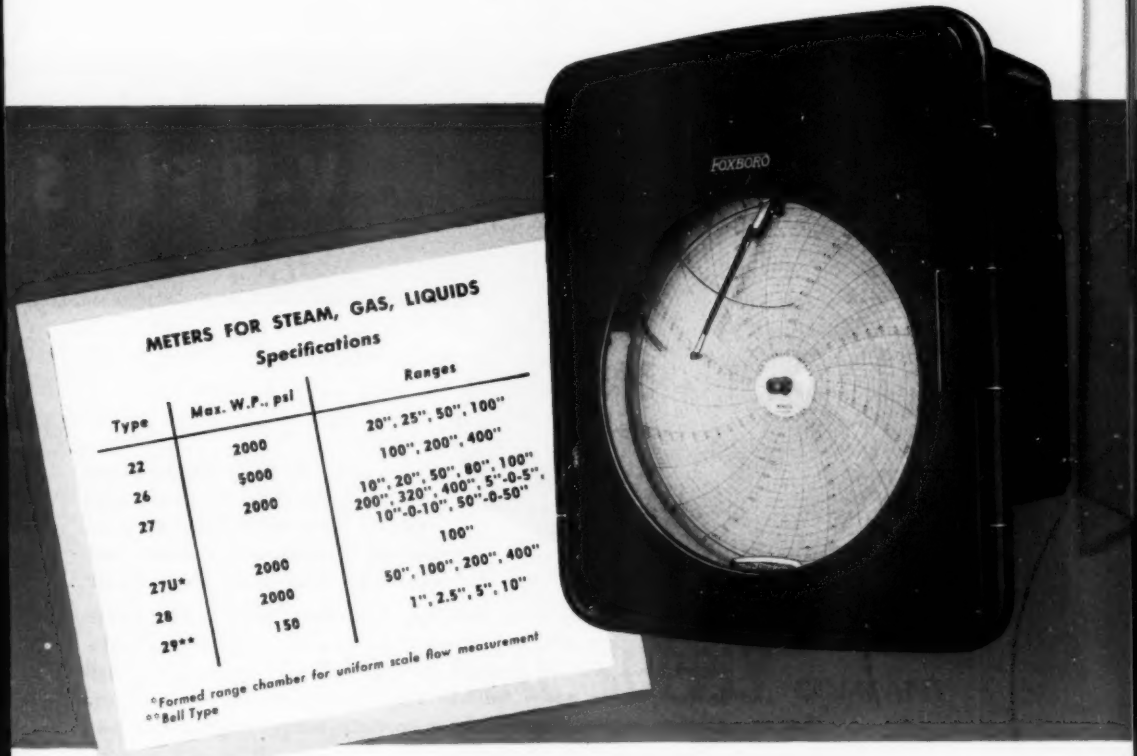
Check up on all the advantages of the new Foxboro Flow Meters. Available in round or rectangular cases . . . as indicators, recorders, controllers or transmitters . . . with or without integrators. There's a type for every metering problem. Write for New Bulletin 460. **The Foxboro Company, 609 Neponset Ave., Foxboro, Mass., U.S.A.**



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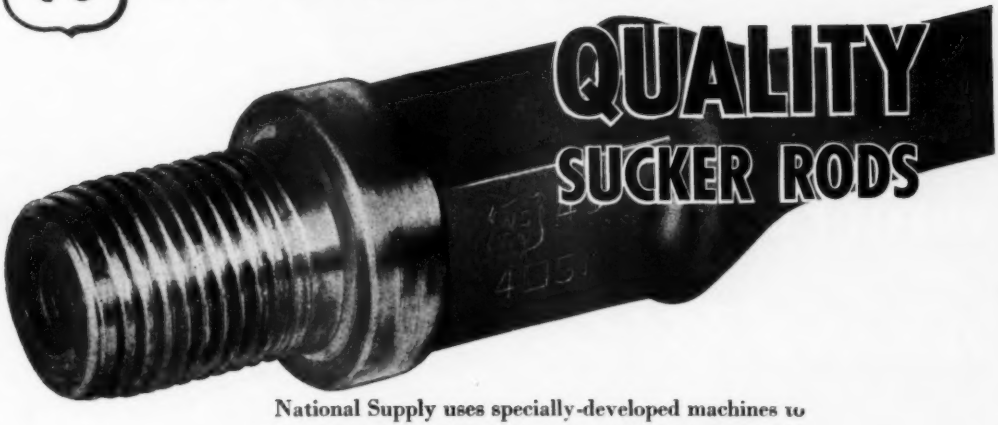

National Supply uses specially-developed machines to forge, upset and thread the top-grade steels specified for National Sucker Rods . . . the Sucker Rods designed to give maximum service for the lowest cost under any pumping conditions.

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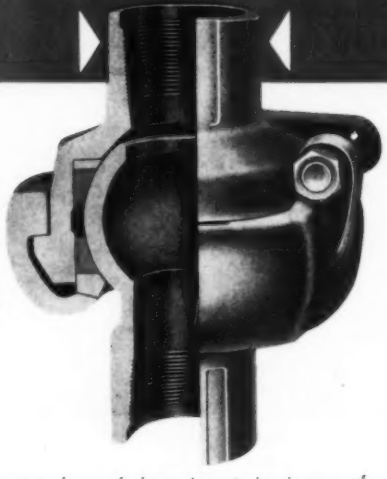
UNIBOLT FLEXI-BALL JOINTS

Relieve the Strain

IT SWIVELS . . . an advantage when making up in a manifold.



IT FLEXES . . . relieving lines of stress due to vibration or misalignment.

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(a patented alloy)

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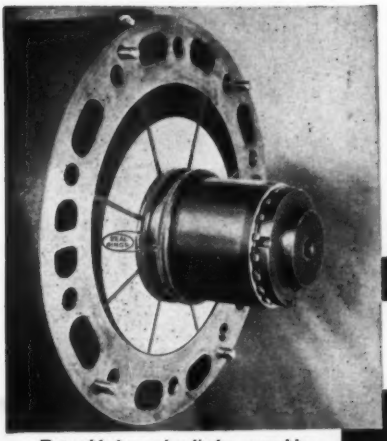
Baltimore	Denver†	Milwaukee	Pittsburgh	Waterbury
Boston	Detroit	Minneapolis	Providence	(†sales office only)
Chicago	Houston†	Newark	Rochester†	
Cincinnati	Indianapolis	New Orleans	St. Louis	

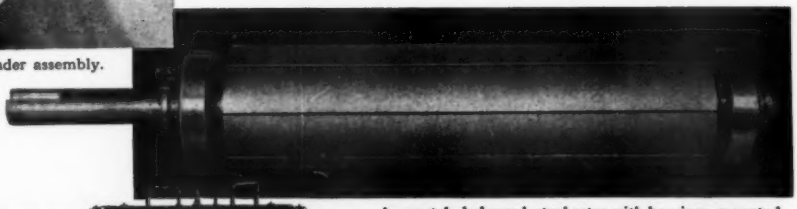
OGS



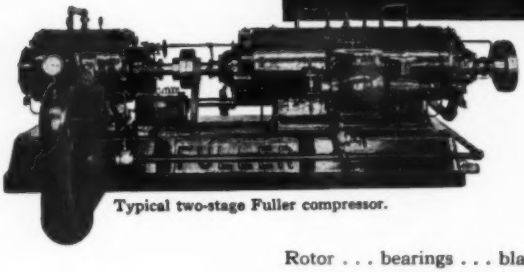
Rotor blades and cylinder assembly.

a lot of maintenance men have never seen inside a

FULLER COMPRESSOR



Accurately balanced, steel rotor with bearings mounted.



Typical two-stage Fuller compressor.

Rotor . . . bearings . . . blades—the only moving parts in a Fuller Rotary Compressor. There you have the three reasons why these compressors keep out of the repair shop. Fuller's efficient "heart" is your guarantee of economical and dependable service.

These are some of the important advantages of the Fuller Rotary—the reasons why thousands of these compressors are quietly and efficiently working for industry today: steady flow—no air-line pulsations, no valves to leak, direct drive from electric motor or internal combustion engine, simple foundation and small floor space, **maintained** capacity and efficiency for the life of the machine.

Whether your requirements call for a single-stage, two-stage or duplex combination, Fuller has the compressor **(to 125 psi. and 3300 cfm)** that will do the job better—longer. Investigate the Fuller Rotary Compressor. Complete information is given in Bulletin C-5. It's yours for the asking.

Fuller

DRY MATERIAL CONVEYING SYSTEMS AND COOLERS • COMPRESSORS AND VACUUM PUMPS FEEDERS AND ASSOCIATED EQUIPMENT

FULLER COMPANY
Catasauqua, Pennsylvania
Chicago 3—120 So. LaSalle St.
San Francisco 4—420 Chancery Bldg.

C-218

WHELAND
delivers the MUD!

ONE-STOP SERVICE at your near-by Jones & Laughlin Supply Company store includes the best slush pump ever built.

For the REASON-WHY information on this Wheland Duplex, ask for Bulletin No. 179. Don't buy a slush pump until you've read it. For engineer or layman it's an eye opener.

350 Horsepower

From discharge pressure of 838 lbs. with 7½" liners to 1,627 lbs. with 5½" liners at 60 R.P.M., this pump delivers the mud!

AMERICA NEEDS SCRAP TO MAKE MORE STEEL
YOU CAN HELP

"... here's My warehouse!"

Jones & Laughlin Supply Company

Subsidiary of Jones & Laughlin Steel Corporation

EXPORT: 405 Lexington Ave., New York, N. Y., U.S.A.

General Offices: TULSA, OKLA.

J&L STEEL

82 Stores • 17 Offices • 6 Resident Salesmen

How can you benefit

from these 34 major pipelines?

How? By applying to your future operations the electrical features developed for these 34 major oil and gas lines. Westinghouse is the source for this information.

Centralized automatic control

For example, in one new Westinghouse-equipped pumping station, centralized automatic control has been applied. The mere pressing of three buttons by a single employee, performs twelve operations in six minutes, that would normally take two or three men an hour. The savings in manpower and increase in revenue through fast starting are tremendous. And there's no chance of damage through opening valves in the wrong order.

Highly flexible and reliable operation

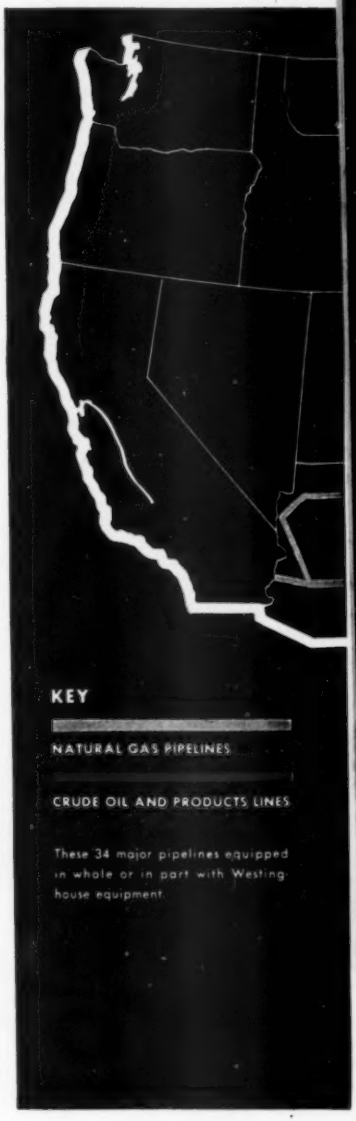
Electrical control has been developed that makes it easier to maintain operating schedules. With such control, all pumping stations can be more easily operated in step. This eliminates the need for storing successive pumpings in balance tanks with the resultant interbatch contamination.

Advancements in Power Systems

Westinghouse has made major advancements in Power Systems for pumping stations. All high-voltage equipment can be enclosed in metal-clad switchgear. This saves installation dollars, makes maintenance more convenient, and provides the ultimate in safety to personnel. The low-voltage circuit breakers and motor controls are centralized in compact Control Centers.

Call Westinghouse early when you plan

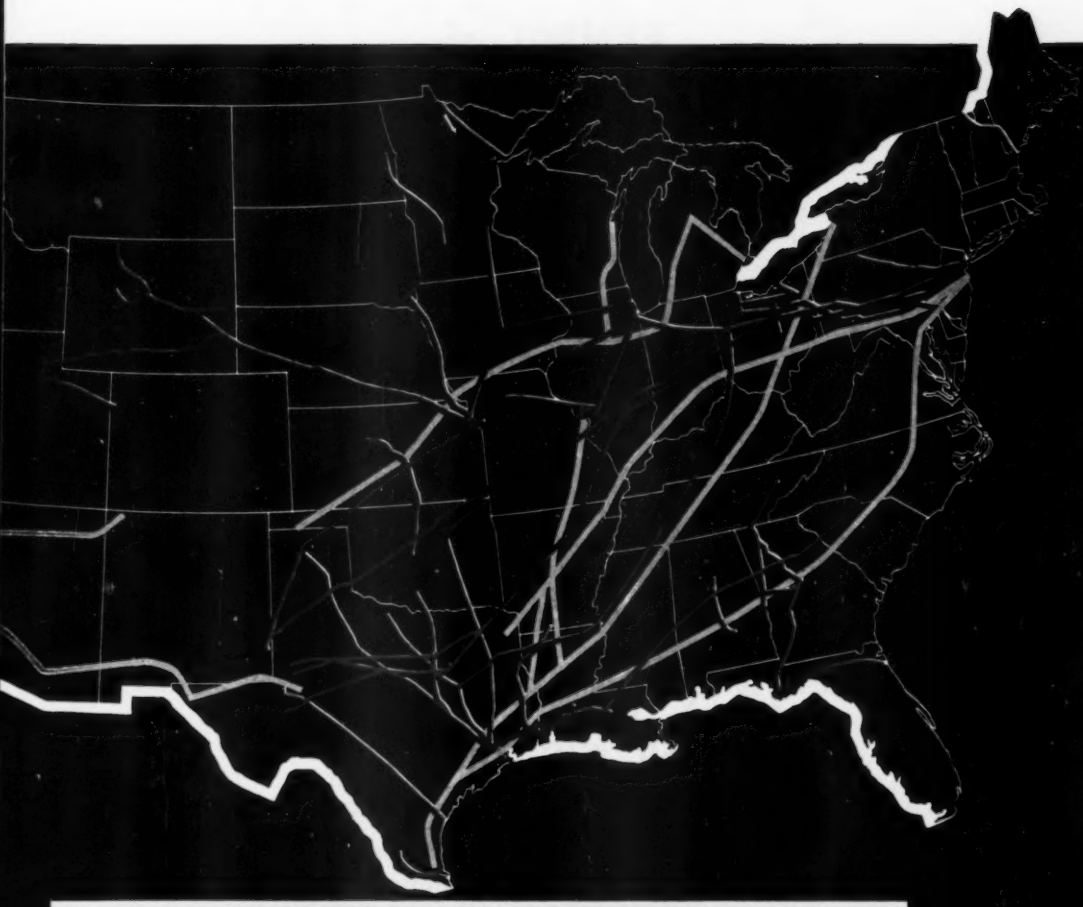
The experience gained in equipping these 34 lines is invaluable. Interest in remotely operated and automatic pumping stations is increasing and it's interesting to note that 20 years ago Westinghouse equipped the first pipeline pumping station for remote supervisory control. And Westinghouse Engineers are continually working on new developments to minimize the cost of pump station attendance. When your next job comes up, call Westinghouse early in the planning stage. Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Penna. J-94883


KEY
NATURAL GAS PIPELINES
CRUDE OIL AND PRODUCTS LINES
These 34 major pipelines equipped in whole or in part with Westinghouse equipment.

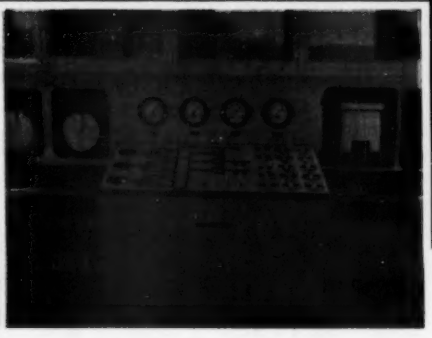
YOU CAN BE SURE.. IF IT'S

Westinghouse

EQUIPMENT FOR THE PETROLEUM INDUSTRY

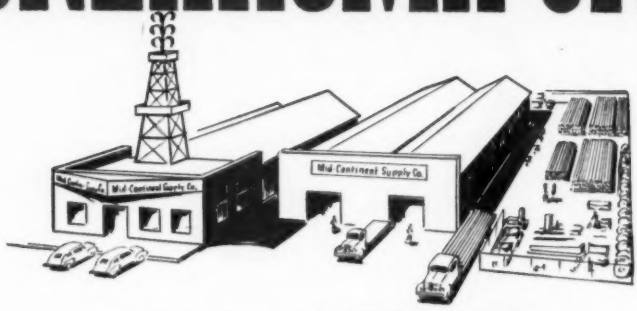


A group of 1,250-horsepower forced-ventilation motors installed in a pumping station of a large crude oil pipeline. All units, including the suction and discharge valves and the ventilation blowers, are remotely operated by a sequence control system.



Pressing buttons on this control desk starts the main pumps and operates valves. Indicating lights show valve position. Other lights identify the operation of protective devices which warn of abnormal conditions. Buttons at right control booster pumps.

SYMBOL of SERVICE and SUPPLY in OKLAHOMA CITY



THIS COMPLETELY STOCKED MID-CONTINENT STORE at 903 SE. 29th ST.

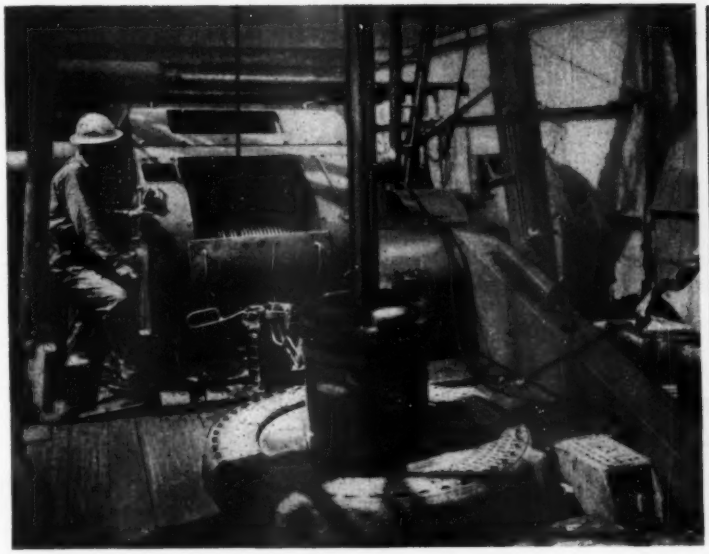
Our completely stocked Mid-Continent Store . . . topped by the famous oil-spouting blue neon derrick, is supplying the oil industry at Oklahoma City. Make this location your supply headquarters in Oklahoma. You'll find a complete stock of the finest equipment and supplies, carrying brand names you've learned to trust for their reliability and dependability.

MID-CONTINENT
Supply Company

General Offices Mid-Continent Bldg. FORT WORTH, TEXAS

THE WORLD'S LARGEST INDEPENDENT OIL FIELD SUPPLY COMPANY

WIRE ROPE



ROEBLING ALL-PURPOSE SLINGS with the Tapered Sleeve Splice come to you ready for the job. They cost less than tucked splices . . . have the full strength of the rope. Send for the full story.

In the oil fields Roebling "Blue Center" Preformed is tops for service and savings

"BLUE CENTER" STEEL wire rope is an exclusive Roebling development. It has to pass the most stringent tests for strength, fatigue and abrasion resistance . . . gives rope the extra long life that spells important economies. Besides, Roebling Preforming assures you top performance on the job. "Blue Center" Preformed is easy to handle . . . has better spooling qualities . . . reduces vibration and whipping.

Roebling makes a complete line of wire rope . . . makes the right grade, and construction for every installation. Have your Roebling Field Man help choose the *right* rope for your equipment. Get his advice on the correct use and maintenance of wire rope. It is based on performance records on thousands of installations. John A. Roebling's Sons Company, Trenton 2, New Jersey.

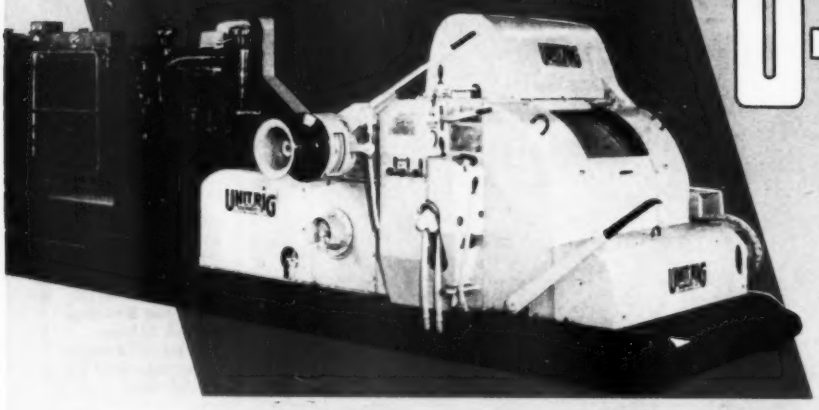
ROEBLING

DISTRIBUTED BY THE NATIONAL SUPPLY COMPANY
REPUBLIC SUPPLY COMPANY

Don't take any more chances than necessary when Drilling for Oil

USE THE TRIED AND TRUE

U-15



The U-15 has continually lead in popularity in practically every oil field where wells to 7,500 feet are drilled. Drillers know they can trust the U-15 when it comes to dependability, speed of operation and economy.

That's why this tried and true drawworks justifies its popularity.

Drilling for oil is a gamble. Don't take any more chances than necessary. Be sure your drawworks won't let you down. Specify Unit Rig's U-15.

UNIT RIG -&- EQUIPMENT CO. TULSA, OKLAHOMA U.S.A.

DESIGNED FOR THE JOB . . .

UR-516

UNIT RIG DRAWWORKS ARE SOLD EXCLUSIVELY THROUGH THESE AUTHORIZED DISTRIBUTORS IN THE U.S.A. AND CANADA.

BOVAIRD SUPPLY COMPANY
HOUSTON OIL FIELD MATERIAL COMPANY
HOWARD SUPPLY COMPANY
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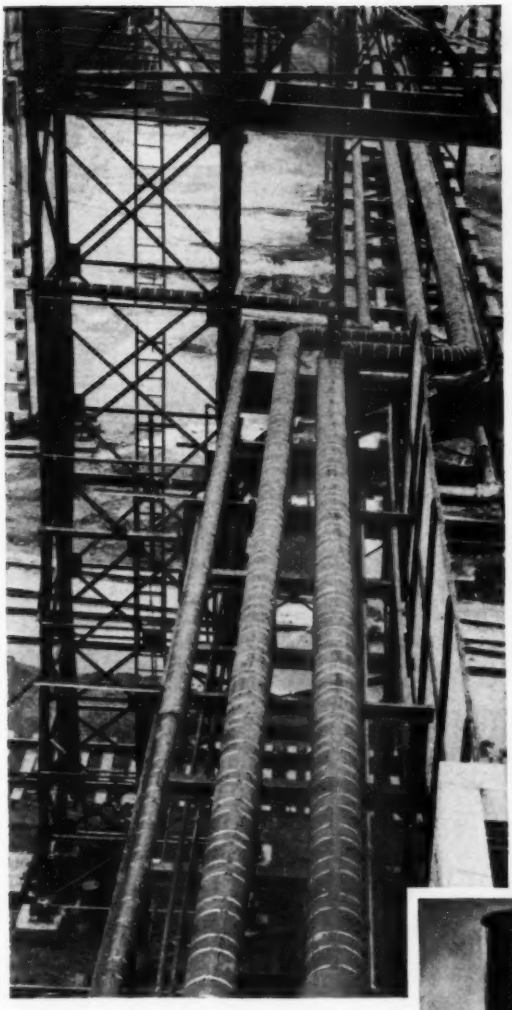
MID-CONTINENT SUPPLY COMPANY
NORVELL-WILDER SUPPLY COMPANY
OIL WELL SUPPLY COMPANY

EXPORT SALES — MID-CONTINENT SUPPLY COMPANY, 42 Broadway, New York City. Cable — MIDUNITRIG



WHICH PIPE NEEDS FOAMGLAS MOST?

● As these fuel oil and steam lines at the Warners, N. J. Plant of American Cyanamid Company must be kept at temperatures of 190° to 390° Fahrenheit, they *all* have a big need for their factory-wrapped FOAMGLAS.

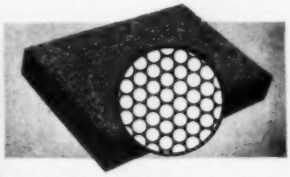
FOAMGLAS — indoors or outdoors — insulates equally well from below zero temperatures to 800°F. It retains its effectiveness. It's light, rigid, durable.

For use on pipe lines of standard sizes, FOAMGLAS is available in two types, "Regular" and "Factory-wrapped." The latter—covered with a glass cloth membrane—is most widely used for temperatures from 212°F. to 800°F., but also can be used for cold applications.

Get the latest information about FOAMGLAS for piping, valves and fittings, tanks and towers, heat exchangers, evaporators and other process equipment. Write for sample and free copy of booklet.

PITTSBURGH CORNING CORPORATION
PITTSBURGH 22, PA.

Factory-wrapped pipe insulation comes with a ready-made finish that may be painted if desired. The FOAMGLAS sections are placed on the pipe, wired or banded, and the flaps then cemented over the longitudinal and end joints respectively. Piping and fitting insulation is fabricated to close tolerances to insure close fit with the equipment and to provide full thickness of insulation. ▶



The best glass insulation is cellular glass. The only cellular glass insulation is FOAMGLAS. This unique material is composed of still air, sealed in minute glass cells. It is light weight, incombustible, verminproof. It has unusually high resistance to moisture, chemicals and other elements that cause insulation to deteriorate.

PITTSBURGH PC CORNING

FOAMGLAS® *the cellular glass insulation*

When you insulate with FOAMGLAS . . . the insulation lasts!

Pittsburgh Corning Corporation
Dept. DD-91, 307 Fourth Avenue
Pittsburgh 22, Pa.

Please send me without obligation, a sample of FOAMGLAS and your FREE booklet on the use of FOAMGLAS for Piping and Process Equipment.

Name.....

Address.....

City.....State.....

P&H DIESEL ENGINES

MINUTES...NOT HOURS!

REPLACE THIS COMPLETE CYLINDER ASSEMBLY

Here's something you can't do with any other diesel. The P&H cylinder assembly (comprising head, liner, piston and rod) fits *any* P&H Model — 1, 2, 3, 4 or 6-cyl. It's built as a unit; stocked as a unit; installed as a unit — anywhere — in minutes . . . not hours or days! Think what this can mean to you in time and money saved. No wonder more and more diesel users are standardizing on P&H Diesels. For literature, write Diesel Division, Harnischfeger Corporation, Port Washington, Wisconsin.

P&H DIESEL DIVISION
HARNISCHFEGER CORPORATION
PORT WASHINGTON WISCONSIN, U. S. A.

Which tube steel is the one and only for you? Ask the experts!

This month's report is on: **SICROMO 5S**

High degree of surface stability under oxidizing conditions up to 1500°F., makes it excellent for air preheater tubes, recuperator and superheater tubes, incinerator equipment. In cracking tubes, offers good resistance to corrosion by hot petroleum and excellent stability up to 1300°F.

23 TIMKEN STEELS FOR HIGH TEMPERATURE SERVICE

Carbon	Sicromo 2	Sicromo 5S	16-13-3
Carbon-Mo.	Sicromo 2½	Sicromo 5MS	25-20
DM-2	2¼% Cr.-1% Mo.	Sicromo 7	25-12
Silmo	Sicromo 3	Sicromo 9M	35-15*
DM	4-6% Cr.-Mo.	18-8 Stainless	16-25-6*
2% Cr.-Mo.	4-6% Cr.-Mo.-Ti.	18-8 Cb	

*Not available as seamless tubing at the present time.

One and *only* one high temperature tube steel can give the best life/cost ratio under a particular set of heat, pressure, corrosion and oxidation conditions.

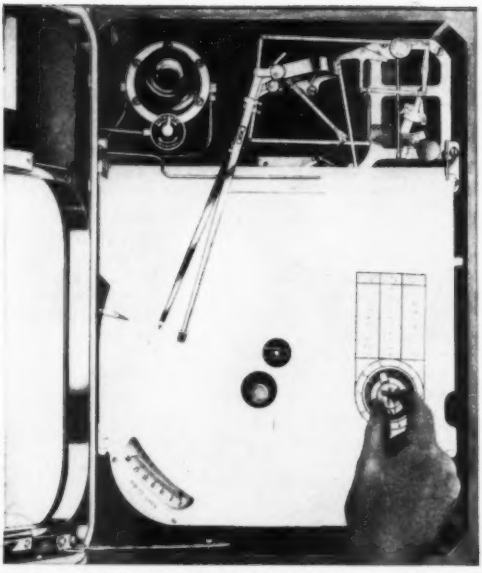
To make sure you select the right steel for *your* operating conditions, get the help of the recognized authorities on high temperature steels—the Timken Company's metallurgists. Their knowledge has been gained through the development and testing of 23 analyses to solve specific high temperature problems. They'll help you choose the one steel out of the 23 that will give you the most life per dollar. And you can be sure that analysis will be uniform from shipment to shipment, because of the Timken Company's complete quality control.

Let our "RSQ"—Research, Supply, Quality—solve your tube problems. Ask the experts! The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

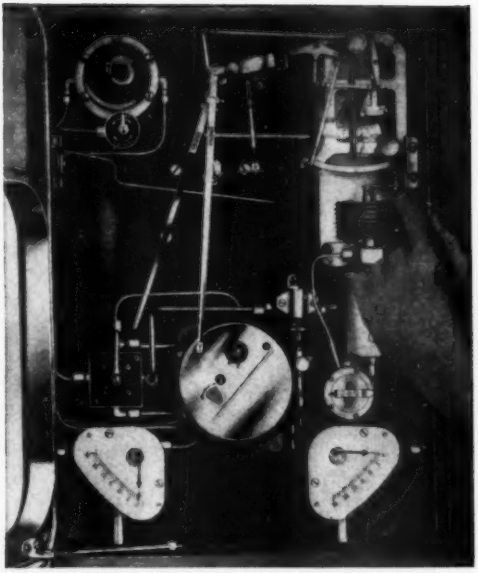
Photo shows furnaces in the Timken Company's experimental heat treating laboratory. Pioneering research on high temperature steels' properties is one big reason for the Timken Company's leadership.

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

Specialists in alloy steel—including hot rolled and cold finished alloy steel bars—a complete range of stainless, graphitic and standard tool analyses—and alloy and stainless seamless steel tubing



EASIEST TO PUT INTO OPERATION—Calibrated control actions save hours of shutdown. Reset, derivative and proportional values can be exactly reproduced at any time on the same or any other Series 500 controller . . . merely by duplicating the setting. Thus: controller adjustments can be standardized for any process throughout a plant or national organization.



EASIEST TO SERVICE—Inherently simple design, using the fewest possible parts, plus extremely close-tolerance manufacturing . . . make the instrument thoroughly interchangeable, trouble-free and a cinch to service. For example: only one simple adjustment puts the system in exact calibration even after complete disassembly and reassembly.

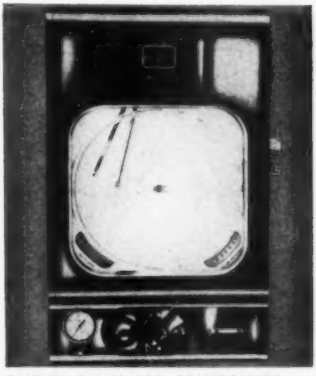
ONLY BRISTOL SERIES 500 CONTROLLERS GIVE YOU THIS EASE OF OPERATION

When you wish to reproduce a previous control action or duplicate one taking place at some other point, the Bristol Series 500 Air-Operated Controller permits you to do it merely by setting a dial.

Or, should the instrument require servicing, only one simple adjustment is needed to calibrate the control system and put it back in operation. Almost anyone can service this instrument.

Furthermore, users report that the Bristol Series 500 Controller requires practically no maintenance.

This outstanding instrument—a product of 60 years of experience—is completely described in Bulletin A120. THE BRISTOL COMPANY, 120 Bristol Road, Waterbury 20, Conn.



BRISTOL SERIES 500 CONTROLLERS are offered in five types—on-off, proportional, reset, derivative, reset plus derivative—to control temperature, flow, pressure, liquid level, humidity, pH. Conversion from one type to another can be made by the user. Model shown has external-manual station with mechanical interlock for test and service.

THE DEPENDABLE GUIDEPOST OF INDUSTRY

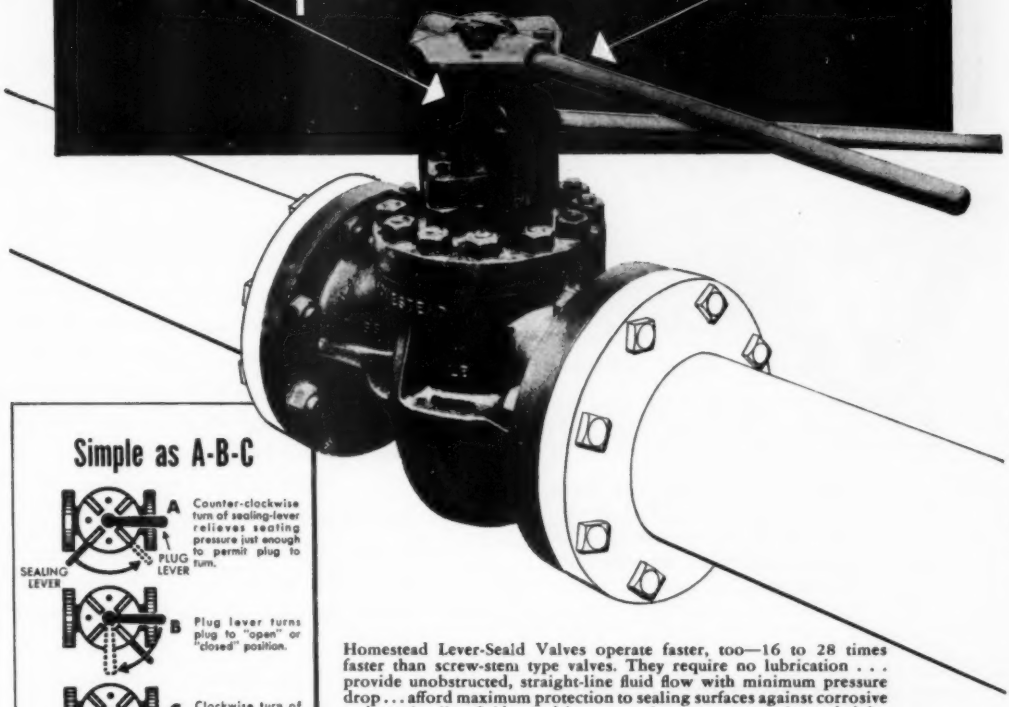
BRISTOL

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

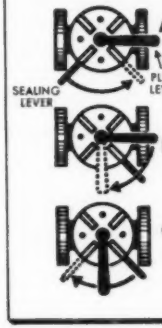
- **at all times**
- **under all conditions**
- **throughout its long lifetime of service**

This Homestead Valve will always work

it's **stickproof** because it's **lever-seald**



Simple as A-B-C



A Counter-clockwise turn of sealing-lever relieves seating pressure just enough to permit plug to turn.

B Plug lever turns plug to "open" or "closed" position.

C Clockwise turn of sealing-lever restores full seating pressure.

Homestead Lever-Seald Valves operate faster, too—16 to 28 times faster than screw-stem type valves. They require no lubrication . . . provide unobstructed, straight-line fluid flow with minimum pressure drop . . . afford maximum protection to sealing surfaces against corrosive and erosive line fluids. And because only a quarter-turn is needed for full opening or closing, they are ideal for installation in restricted areas where operation of other types of valves might be difficult.

Next time you have damaged or sticking valves, replace them with Homestead Lever-Seald Plug Valves. Once you use them you'll never be satisfied with ordinary valves.

For complete information write for Valve Reference Book No. 39-3.

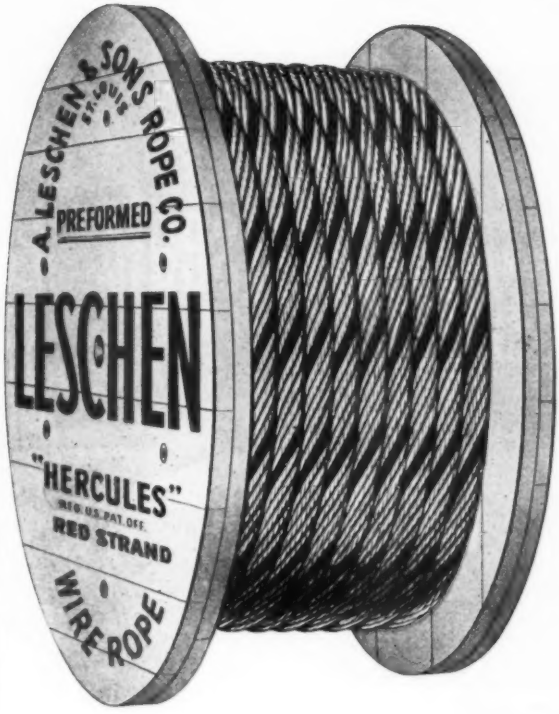
HOMESTEAD LEVER-SEALD PLUG VALVES

HOMESTEAD VALVE MANUFACTURING COMPANY

Serving since 1892

P.O. BOX 403 CORAOPOLIS, PA.

The tougher the job...



the greater the need for

"HERCULES"
REG. U.S. PAT. OFF.
RED-STRAND
WIRE ROPE

Its fitness for tough work has been proved by many years of actual on-the-job performance. Strength, toughness, flexibility, and durability . . . *in correct balance* . . . provide safe, dependable, and economical wire rope service.

"HERCULES" (Red-Strand) Wire Rope was originated by Leschen in 1886 to meet the rope requirements of bigger, better material handling equipment—and tough jobs have been its proving grounds ever since.

Let the Red-Strand be *your* wire rope guide. You will find its reputation justly earned.

Round Strand or Flattened Strand – Preformed or Non-Preformed – Wire Rope Core or Fiber Core. Let us help you select the *right* rope for your job.

We Invite Your Inquiries

MADE ONLY BY

A. LESCHEN & SONS ROPE CO. 5909 KENNERLY AVE. • ST. LOUIS 12, MO.

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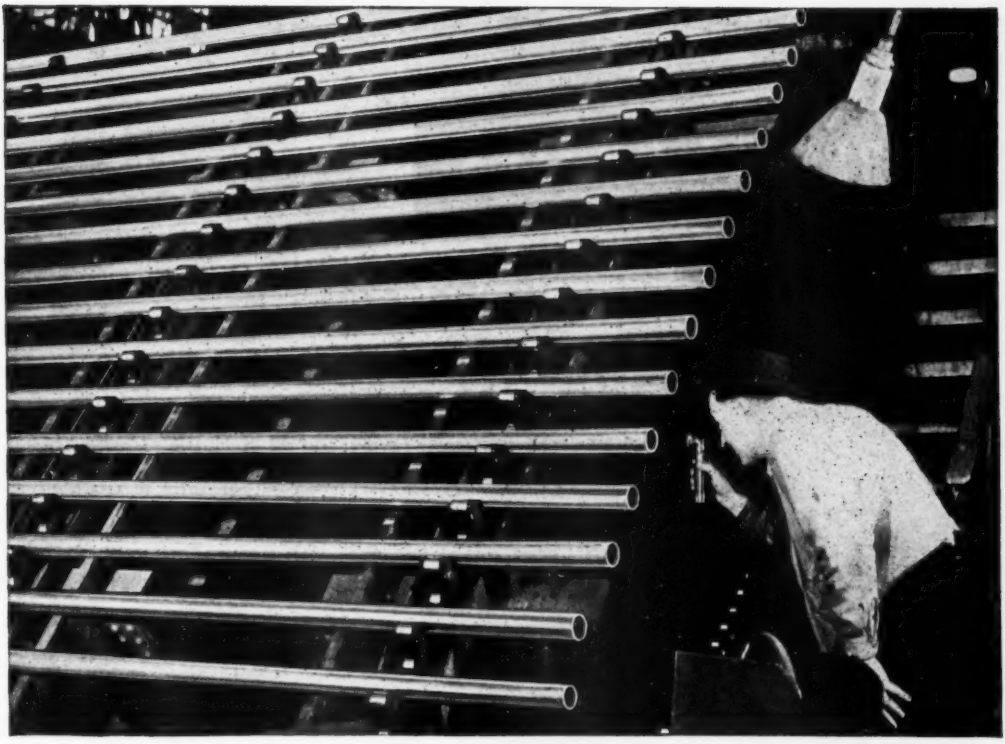
New York 6 · Chicago 7 · Birmingham 6 · Houston 3 · Denver 2 · Los Angeles 21 · San Francisco 7 · Portland 9 · Seattle 4



***SPECIALIZATION* GIVES YOU UNIFORM HIGH QUALITY IN**

GLOBE ALLOY STEEL TUBES

When you specify GLOBE you get the finest, because Globe *specializes* in the production of steel tubes. For more than thirty years Globe *specialized* research, engineering and manufacturing facilities have assured customers of uniform high quality in alloy steel tubes for pressure or mechanical applications.

GLOBE STEEL TUBES CO., Milwaukee 46, Wis.

Chicago • Cleveland • Detroit • New York • Philadelphia
St. Louis • Denver • San Francisco • Glendale, Cal.

Producers of Globe seamless stainless steel tubes — Gloweld welded stainless steel tubes — alloy — carbon — seamless steel tubes — Globeiron (high purity ingot iron) seamless tubes — Globe Welding Fittings.

TYPICAL ANALYSES:

Carbon Moly.
1-¼ Chrome ½ Moly • 1-¾ Chrome ¾ Moly
2 Chrome ½ Moly • 2-¼ Chrome 1 Moly
5 Chrome ½ Moly • 7 Chrome ½ Moly
9 Chrome 1 Moly
A1S1 1335 • A1S1 2317 • A1S1 2512 •
A1S1 4130, 4140 • A1S1 4615 • A1S1 8615,
8620, 8630, 8635, 8640 • 7% Ni. • 9% Ni.

TYPICAL APPLICATIONS

Pressure Tubes — Superheater Tubes — Condenser Tubes — Still Tubes — Evaporator Tubes — Barrel Tubes — Oil-Well Pump Barrels — Mechanical Tubes — Aircraft Tubes—Rollers for Transmission Chains

GLOBE SEAMLESS TUBES FOR MAXIMUM STRENGTH AND MINIMUM WEIGHT

Pierced from solid steel billets . . . with no seams or welds, Globe seamless tubes are available in many sizes and wall thicknesses for exacting applications.

REPEAT ORDERS

. . . tell the story of Farrel Speed Increasers

There is one very good reason for the many repeat orders which Farrel receives from old customers each year: *No Farrel speed increaser has ever failed on the job.* Every unit installed since 1932, when the SI line was first placed on the market, is still in operation, performing as well as on the day it was placed in service. This "perfect record" provides a virtual guarantee of trouble-free operation.

Send for full information about these service-proved speed increasers. Ask for a copy of Bulletin No. 448A. No cost or obligation.

FARREL-BIRMINGHAM COMPANY, INC., ANSONIA, CONNECTICUT

Plants: Ansonia and Derby, Conn., Buffalo, N. Y. *Sales Offices:* Ansonia, Buffalo, New York, Boston, Pittsburgh, Akron, Cleveland, Detroit, Chicago, Portland (Oregon), Los Angeles, Salt Lake City, New Orleans

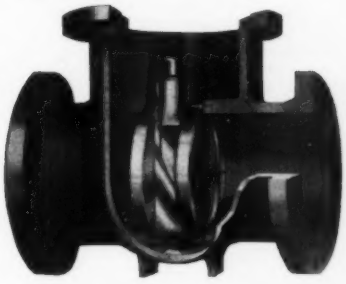
OIL FIELD REPRESENTATIVES: Hercules-Lupfer Engine Sales Co., 124 N. Boston St., Tulsa 1, Okla. V. W. Osborne, 860-A M&M Building, Houston 2, Texas

Farrel-Birmingham®

Five speed increasers transmitting 200 HP, with a 10½ to 1 step-up, to high-pressure pipeline centrifugal pumps. This company has ordered sixty similar units since 1932.

FB-665

Cutaway showing extreme simplicity of Darling's unique fully revolving double disc parallel seat gate valve principle.



TROUBLE-FREE SERVICE

because it's a

DARLING

cast steel pipe line gate valve

Darling 20" motor-operated series 600 gate valve of the revolving disc type on a major oil line.

LET'S go on record that there's probably no other pipe line valve that can match a Darling gate valve in *avoiding* the most common operating troubles. Darling users have been finding this out on all their cross-country lines.

Back of it is Darling's *fully revolving double disc parallel seat principle.* This results in automatic compensation for valve body distortion, uniform distribution of disc and seat wear, and positive closing. And, naturally, these things add up to longer valve life *with the lowest maintenance and least trouble.*

If you're not already using Darling Pipe Line Gate Valves, it will pay you to take a few minutes to get fully acquainted with the unique Darling double revolving disc principle and its many advantages.

SEND FOR DATA

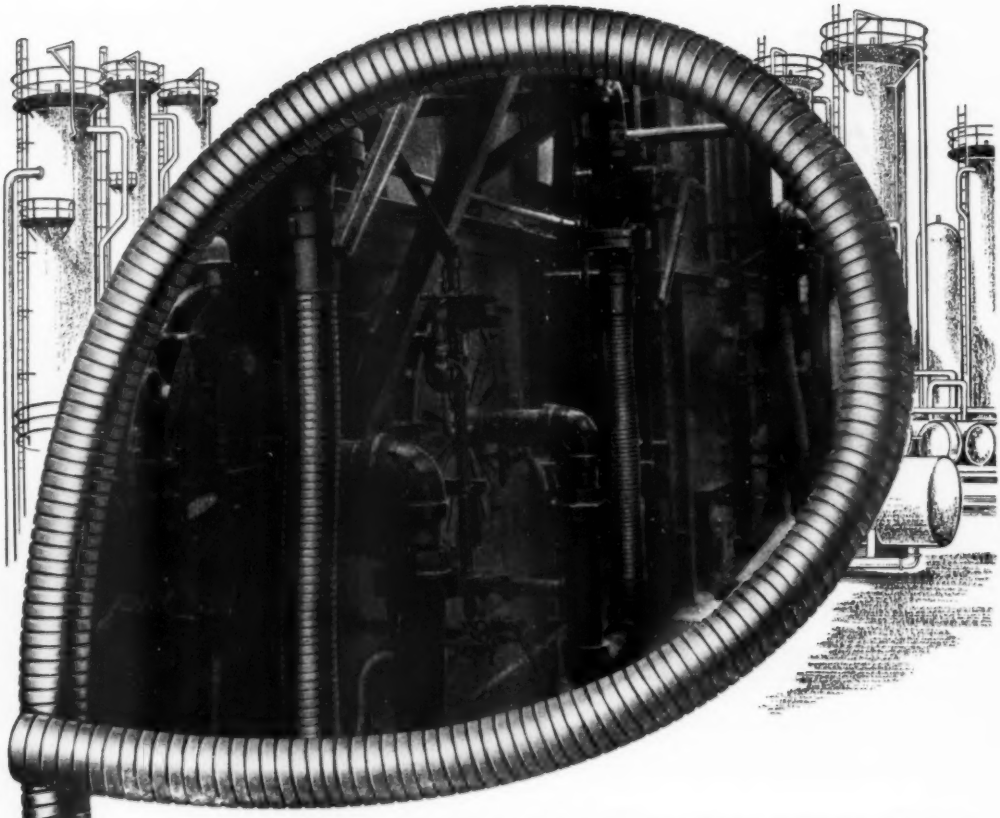
Darling Parallel Seat Gate Valves come in a wide range of sizes and types for all gas and oil line requirements. Simply outline your particular service needs or ask for a complete descriptive bulletin.

DARLING VALVE & MANUFACTURING CO.

Williamsport 1, Pa.

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ont.

FOR PLUS VALUES, JOB-PROVED AGAIN AND AGAIN



CORRUGATED "MUSCLES" THAT LET PIPES MOVE

PENFLEX METAL HOSE ABSORBS THERMAL EXPANSION . . . PREVENTS JOINT LEAKS

Petroleum still burners like this one in Kermit, Texas, put heavy strains on piping. Thermal expansion, contraction and physical shock make safe sealing of burner pipe joint assemblies a vital requirement.

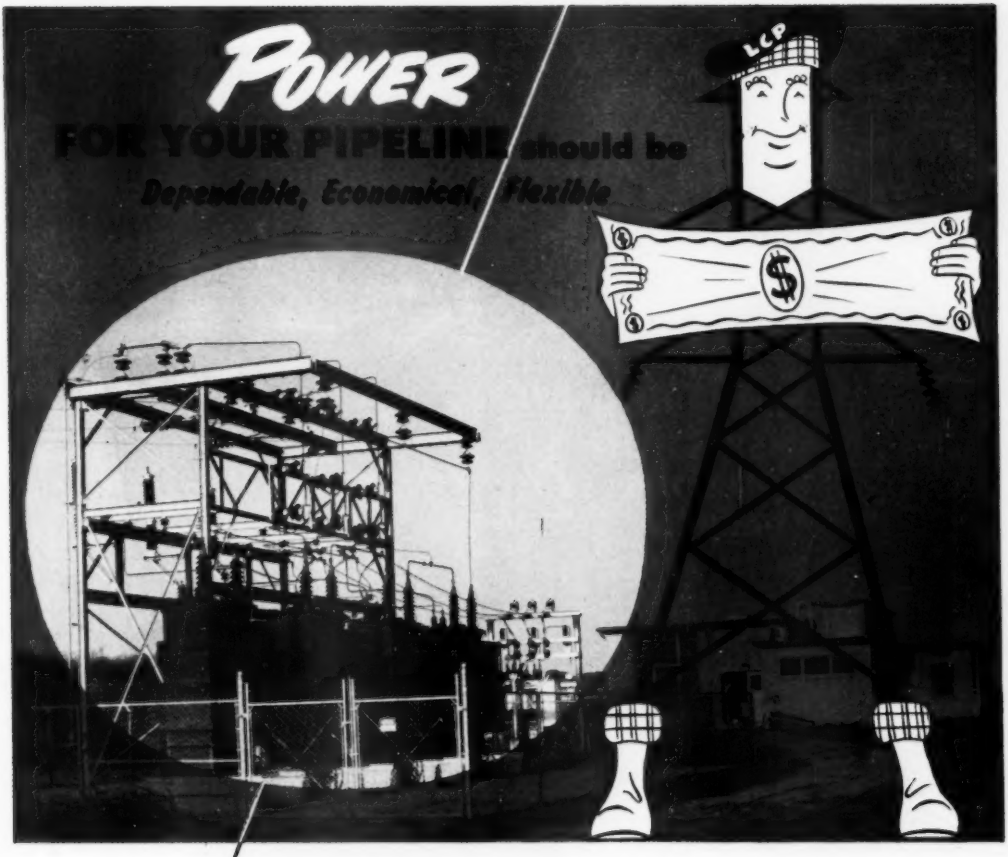
Penflex flexible metal hose with couplings is used on these burners to absorb any pipe movement due to extreme temperature and pressure changes. Lengths of 4" I.D. interlocking, four-wall galvanized steel hose are installed on each burner. Provides outstanding safety and high, uninterrupted flow of volatile fluids. Leakproof, tough and *flexible*.

Penflex engineers can help you solve flexible tubing application problems. Penflex manufactures a complete line of four-wall, interlocking and seamless welded corrugated tubing . . . from ⅛" I.D. and up . . . automatic barrel fillers, accessories and fittings. Write for illustrated folder, "Flexineering," containing valuable flexible tubing data for your product application.

Pennsylvania Flexible Metallic Tubing Company, Inc., 7213 Powers Lane, Phila. 42, Pa.
Branch Sales Offices: **Boston • New York • Chicago • Houston • Cleveland • Los Angeles**

penflex

HEART OF INDUSTRY'S LIFE LINES



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LOW COST POWER handles the biggest jobs with trouble-free efficiency. If the job is only a fractional horsepower motor, Utility Electric LOW COST POWER is your best bet, too. . . . You get all the advantages of low operating, maintenance and labor costs . . . easy portability . . . fast starting in all weather . . . s-l-o-w depreciation. Save on initial cost of power-driven equipment. Save on repairs. *Everything's up* EXCEPT *Utility Electric Power.*

PETROLEUM ELECTRIC POWER ASSOCIATION

IT'S PACKED WITH SATISFACTION WHEN IT'S PACKED WITH R/M

Typical of the hundreds of different types of equipment packed with Raybestos-Manhattan packings is this high-pressure rotary air compressor. The complete R/M line includes packings and gaskets for service against air, gas, water, oil, steam, petroleum products, chemicals, food products, and practically every gas or liquid used in industry. Your nearby R/M distributor will help select the proper packing or gasket to meet your needs. Or write for the R/M Packing Catalog.

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RAYBESTOS-MANHATTAN, INC.

PACKING DIVISION, MANHEIM, PA.

FACTORIES: Bridgeport, Conn. Manheim, Pa.
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Most Practical Versatile, Economical

4-PLACE, ALL-METAL PLANE ON THE MARKET

... Priced Several Thousand Dollars Lower

THAN ITS NEAREST COMPETITOR!

The Cessna 170 gives amazing comfort with four roomy, adjustable, foam rubber seats, large luggage compartment.

Your transportation problems solved. Fly 500 miles non-stop at a fast cruise and average 15 non-expensive miles to the gallon.

No more shouting during flight. Improved engine mount, glass insulation, airtight door seal and new type mufflers enables normal conversation.

Maneuvers like a small ship yet has "big ship" feel and stability. Tapered semicantilever high-wing design is the answer! Selective-action 50 degree flaps, adjacent trim control and better visibility makes short-field landings safe and easy. Powerful, easy acting, non-fade brakes and patented shock-proof landing gear make rough fields velvet-soft.

The great Cessna 170 does *almost anything!* Quickly transforms from luxurious cabin cruiser to aerial workhorse. Remove rear seat for cargo-sized hold in 3 minutes, or: install floats for an outstanding seaplane . . . skis for winter weather . . . cross-wind wheels for single-strip all-wind conditions . . . a stretcher for rescue work . . . spraying equipment for farm-crop use.

Cessna 170

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Please send free literature giving complete description of the Cessna 170.

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Cessna 190 SERIES

ON DISPLAY AT YOUR CESSNA DEALER'S . . . CESSNA 190 Series

This bigger, more beautiful Cessna is perfect for business use. Over 160 m. p. h. comfort for 5. Easy to operate, economical to use. Airline-type engines and Hamilton Standard Constant Speed Propellers. See its multiple advantages!

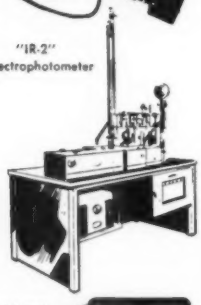
***During 1950, the Cessna 170 outsold all other four-place airplanes, regardless of price.**

Mark of a *modern* refinery...

In both industry and science the name "Beckman" has become synonymous with leadership in a vital field of instrumentation—that of adapting complex scientific advancements to the quick, simple, accurate solution of modern production, analytical and control problems. If you are not using these Beckman Instruments in *your* operations, we suggest you investigate today the vital savings they can make for you...

"DU" Spectrophotometer

"IR-2" Spectrophotometer



Model "R" pH Indicator

OTHER BECKMAN INSTRUMENTS include the Photopen Recorder, the Ultrohmeter, numerous types of Radiation Meters, and other advanced equipment for specialized applications. For modern instrumentation needs bring your problem to Beckman.

BECKMAN "DU" QUARTZ SPECTROPHOTOMETER:

Widely used by leading refineries to simplify the measurement and control of aromatics, butadiene and other refinery products that are readily analyzed by visible and ultraviolet light. With this instrument, complex analyses requiring many hours by other methods can be made—accurately—in a few minutes. Butadiene analyses can be made to an accuracy within 1/10 of 1% of total original sample.

Makes toluene determinations in minutes instead of hours—accurate to within 1% of toluene present over concentration range 0.01 to 100%. Also simplifies many other refinery applications with similar speed and accuracy.

Covers wide spectral range—near infrared, visible and ultraviolet—and entire instrument is designed for maximum accuracy, operating simplicity and compactness. Unusually rugged construction minimizes maintenance and insures sustained accuracy. Incorporates many unique design features. *Write for full details.*

BECKMAN "IR-2" INFRARED SPECTROPHOTOMETER:

Originally developed to simplify control problems in refinery operations, Beckman Infrared equipment and methods have been widely adopted by other industries as well.

The "IR-2" Spectrophotometer is the most advanced infrared equipment available and embodies far-reaching developments that greatly increase the versatility, accuracy, speed and convenience of modern infrared methods.

Analyzes hydrocarbons and other organic gases, liquids and solids by measuring absorption of infrared radiation at selected wave lengths, permitting rapid identification of each component—and its concentration—in complex mixtures. It is many times faster than other methods... is accurate to within ½ of 1% of *total* sample present... is simple to use and readily analyzes even the most complex mixtures encountered in modern refinery operations.

This instrument is widely used in leading refineries throughout the world, and no refinery, large or small, can be completely modern in its operating efficiency without Beckman "IR-2" equipment. *Write for full details on the many outstanding design and performance features incorporated into this equipment.*

BECKMAN GLASS ELECTRODE pH EQUIPMENT:

Extensively used throughout the refining industry to control pH in various processing operations, and to reduce costly corrosion of plant equipment by neutralizing acid crudes and similar corrosive elements.

Beckman—pioneer of modern glass electrode pH equipment—offers the widest range of pH instruments and the industry's most complete range of glass electrodes for use with its instruments.

There is a Beckman pH instrument for every application—laboratory, plant and field, as well as *completely automatic* equipment for large-scale pH indication, recording and control. Illustrated at left is the Beckman Model R Indicator for automatic pH installations, one in a complete range of pH instruments. *Write for descriptive details on Beckman pH equipment.*

Our trained research staff will outline the important savings you can make by installing Beckman instruments on *your particular* operations. Write, wire or phone for further details. *Beckman Instruments, Inc., South Pasadena 24, Calif.*

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INSTRUMENTS CONTROL MODERN INDUSTRIES

pH Meters and Electrodes — Spectrophotometers — Radiation Meters — Special Analytical Instruments

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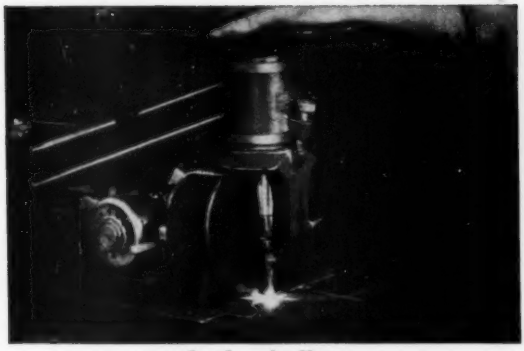
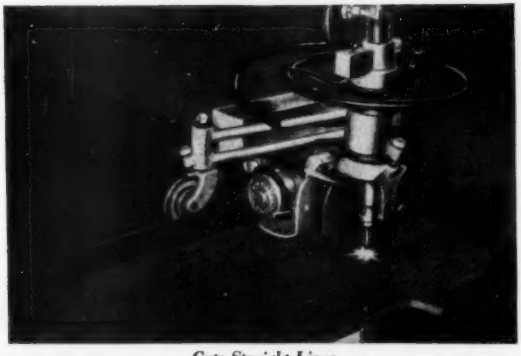


Cuts Irregular Shapes



Cuts Straight Lines

Cuts Circles

In large and small shops alike, the OXWELD CM-16 Portable Cutting Machine fills an unbelievably wide variety of oxygen cutting requirements. It cuts circles automatically. Hand-guided, it cuts irregular shapes. Operated on track, it cuts straight lines.

Indoors or out—wherever steel needs shaping—the CM-16 makes it easy to "tailor" parts as fast as the work can be laid out. *And its ready adaptability for special jobs is limited only by its operator's ingenuity!*

The CM-16 sets up as quickly as any manual outfit. It weighs only 45 lb., travels directly on the work, and is easy to carry from job to job. In normal use, it cuts up to 4 in. of steel; with standard accessories, it cuts materials up to 18 in. thick and it cuts bevels.

Any LINDE representative will be glad to show you how the OXWELD CM-16 Portable Cutting Machine can boost production and cut fabricating costs in your shop. Write for catalog, Form 4487, or call the LINDE Office nearest you today for a free demonstration.

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Manufacturing Facilities

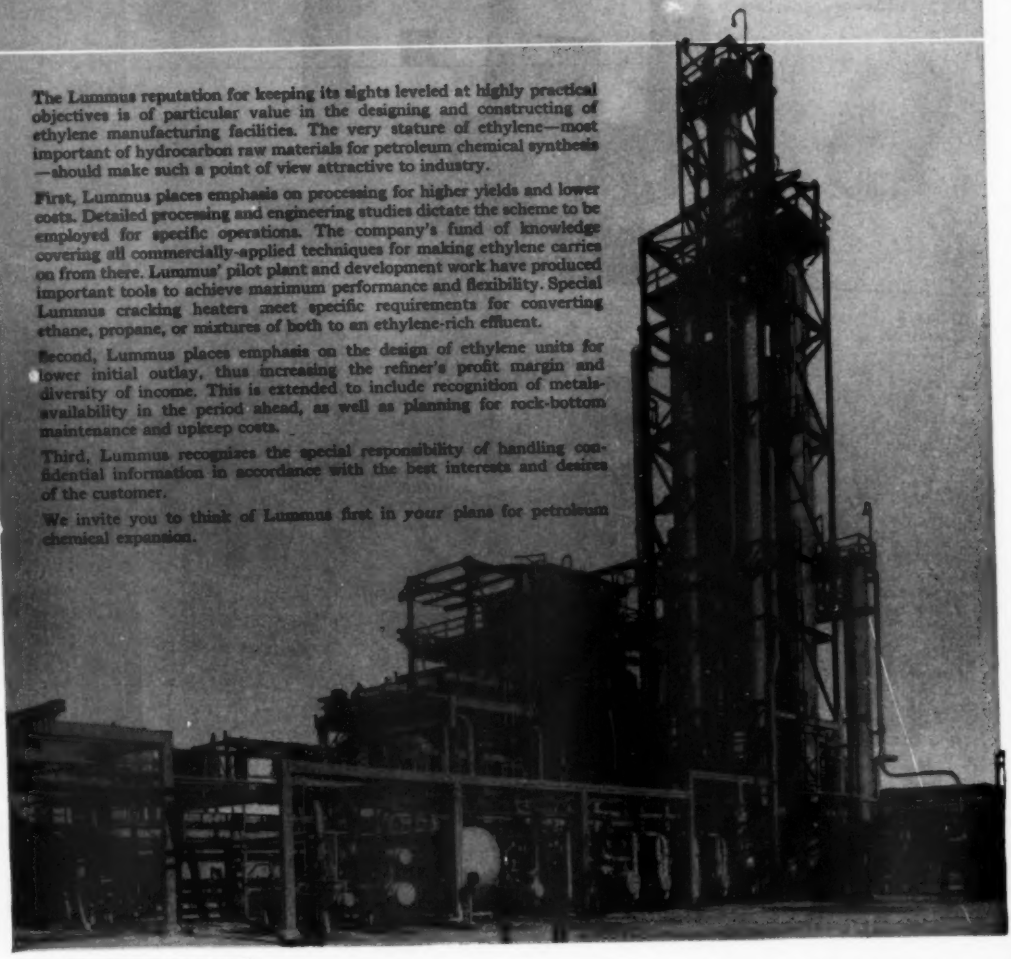
The Lummus reputation for keeping its sights leveled at highly practical objectives is of particular value in the designing and constructing of ethylene manufacturing facilities. The very stature of ethylene—most important of hydrocarbon raw materials for petroleum chemical synthesis—should make such a point of view attractive to industry.

First, Lummus places emphasis on processing for higher yields and lower costs. Detailed processing and engineering studies dictate the scheme to be employed for specific operations. The company's fund of knowledge covering all commercially-applied techniques for making ethylene carries on from there. Lummus' pilot plant and development work have produced important tools to achieve maximum performance and flexibility. Special Lummus cracking heaters meet specific requirements for converting ethane, propane, or mixtures of both to an ethylene-rich effluent.

Second, Lummus places emphasis on the design of ethylene units for lower initial outlay, thus increasing the refiner's profit margin and diversity of income. This is extended to include recognition of metals-availability in the period ahead, as well as planning for rock-bottom maintenance and upkeep costs.

Third, Lummus recognizes the special responsibility of handling confidential information in accordance with the best interests and desires of the customer.

We invite you to think of Lummus first in *your* plans for petroleum chemical expansion.



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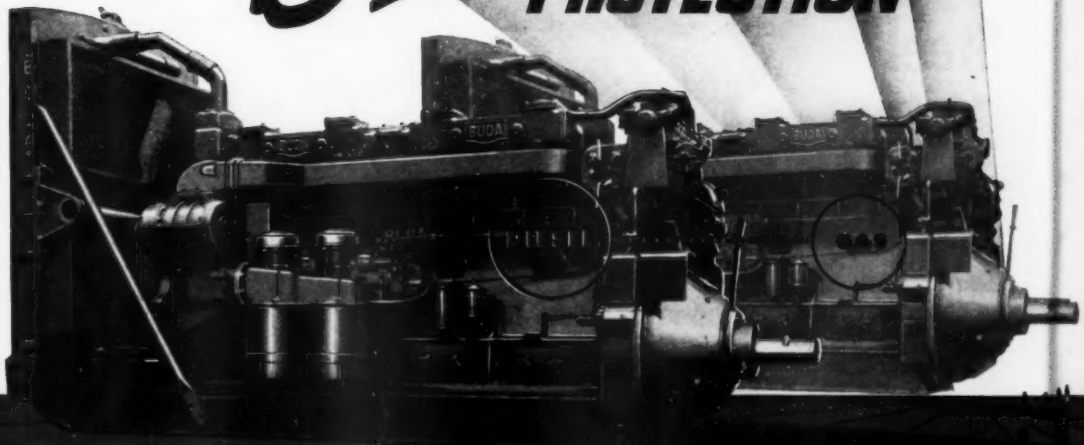

Pick the cheapest fuel...gas or diesel when you own a BUDA "2505" Series Engine and the "Fuecomizer" Package. This is your answer to the high fuel cost problem.

Ask your nearby BUDA Oilfield Distributor for full details on the 2 for 1 "2505" engine deal today. Data and specifications furnished without obligation. BD-20

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For Features that Mean Long Valve Life and Low Cost Service Get this ALL-Purpose Edward Forged Steel Globe Valve

Edward Fig. 444-448 series, built in sizes ⅛ to 2 in. inclusive . . . forged steel globe and angle . . . 600 and 1500 lb sp . . . bolted or union bonnet . . . screwed or socket welding ends . . . Fig. 448 illustrated.

CHECK THESE Big 7 FEATURES

- ✓ Hard bronze yoke bushing to prevent stem seizing or galling . . . lock welded to yoke
- ✓ Packing is Edward EValpak . . . heat resistant, water-proofed and die molded for long service
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Your needs designed it....

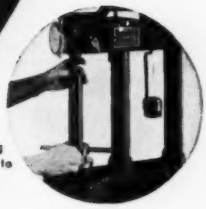
In the Marsh Mastergauge you have a refreshing example of the success that can be achieved by squarely facing a full set of conditions and setting out to lick them one by one.

Your needs — your conditions — designed the Mastergauge line. They are tough conditions — the vibration and pressure surges of drilling; the pulsation of the pipe lines; the extreme pressures and temperatures of the refinery. Sometimes all of these conditions are imposed on a single pressure gauge.

But the Mastergauge is built to meet these conditions all the way. It took the kind of experience Marsh has accumulated in 80 years of instrument making to accomplish this. Just a few of the techniques that have contributed to the outstanding success of the Mastergauge line are illustrated here.

Latest development in the Mastergauge line is the advanced Xmas Tree Gauge. Your supply house wants to sell you these finer gauges.

MARSH INSTRUMENT CO. *Sales affiliate of Jas. P. Marsh Corporation,* **Dept. L, Skokie, Ill.**
Houston Branch Plant: 1121 Rothwell St., Sect. 15, Houston, Tex.



Here each lot of tubing is tested for hardness to make sure it is up to Marsh standards.

Meshing of rack and pinion magnified 50 times here to check alignment.

Pulsation tests like this have shown the way to make gauges that can take it in the field.

A brutal vibration test — tougher than any field conditions — shows how to make gauges that can stand up in the oil country.

The Gauge with the "Recalibrator"

The toughest gauge to knock out of adjustment is the easiest to get back in . . . thanks to this feature — the "Recalibrator."

MARSH GAUGES

FIGHTING HEART

...of all this equipment!

Chrysler Industrial 15—
one of eight basic models.

CHRYSLER-BUILT INDUSTRIAL ENGINES ARE THE SOURCE OF POWER FOR:

- Ditching Machines
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Original equipment manufacturers the nation over install Chrysler Industrial Engines in their equipment because Chrysler-built means better performance . . . rugged dependability . . . trouble-free operation . . . longer operating life, service everywhere.

Continuous Chrysler research in higher alloy steels and famed Chrysler engineering have produced an industrial engine capable of sustained high speeds with less wear . . . an engine that costs less to operate, less to maintain.

A letter of inquiry will bring you a qualified Chrysler engineer. Address: **Industrial Engine Division, Chrysler Corporation, Detroit 31, Michigan.**

CHRYSLER
Industrial Engines

Don't let corrosive media *eat away your profits!*

We know that to have production in the Chemicals or Process Industries you must have corrosive media. We also know that "down time" caused by corroded valves slows up production and therefore "eats away" your profits.

But why worry? Powell makes valves of the *right* materials to resist the action of every known form of corrosive media encountered in these industries.

Gate, Check, Globe and Y Valves, in Bronze, Iron, Steel and Corrosion-Resisting Metals and Alloys

★ *Quality fine throughout "The Line"* ★

Fig. 2453-G. Large 150-pound O. S. & Y. Gate Valve. All the dimensions conform to the latest standards. Can be furnished in: Stainless Steels, Hastelloy Alloys, Monel Metal, Herculoy, Everdur, Inconel, Nickel, and other metals and alloys.

POWELL

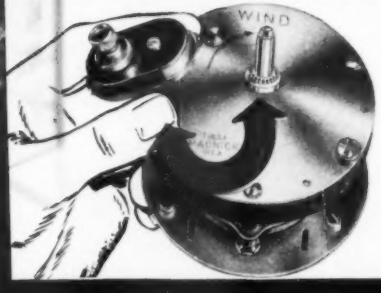
The WM. POWELL CO., 2525 Spring Grove Ave., P. O. Box 106, Station B, Cincinnati 22, Ohio

Mighty Midgets

SHOWN ACTUAL SIZE

Left to right: Rockwell 24 hour wind and 8 day wind midget mechanical drives with rotation-converting Turret that, on the eight day model, permits one basic drive to be adapted to as many as 11 different speeds.

dependable, convenient drives for Meters, Controls, Recorders



THE TURRET ON TOP *does the trick!*

The above illustration shows how Turrets lock onto the chart arbor of the eight day model to change rotation speeds. The eight day drive is basically 24-hour rotation. Turrets are available for chart rotation times of 2, 3 4, 6, 8, 12 and 48 hours; 3, 7 and 8 days.

THE **MOST** CHART DRIVE IN THE **LEAST** SPACE

Rockwell Midget Chart Drives fill the need for compact, powerful mechanical drives in instruments where space is at a premium. They are strongly constructed with cases of die cast aluminum, gears mounted in phosphor bronze bearings and an escapement case made of stainless steel and clear plastic. This escapement snaps into place without tools and is readily replaceable.

Rockwell Midgets wind through the chart arbor. They snap into a separate mounting ring only 3¼″ in diameter which may be positioned on bosses or adaptors to fit any instrument case.

This combination of small size, versatility of application and precision construction makes Rockwell Midgets the most economical drives to use. It will pay you to specify them in instruments made by any manufacturer.

ROCKWELL MANUFACTURING COMPANY

PITTSBURGH 8, PA.

Atlanta • Boston • Chicago • Columbus • Houston • Kansas City
Los Angeles • New York • Pittsburgh • San Francisco • Seattle • Tulsa

ROCKWELL CHART DRIVES

TOPS in Oil Pipe Line Pumping Power

Fuel flexibility, operating economy, continuous pumping station service that can't be interrupted by fuel shortages—these are the basic reasons why more and more oil transportation and pipe line companies are installing dual-fuel engines for pumping power at its best. Enterprise Dual Fuel Engines combine all these important advantages to provide highest engine efficiency at lowest power cost through three-way fuel flexibility:

1. **Handles any combination of gas and oil,** from full diesel to about 95% gas, 5% pilot oil. Change-over from one fuel to the other is smooth, positive and instantaneous through simplified controls.
2. **Burns Diesel, crude and residual fuels.** Many grades of properly prepared "heavy" fuels can be used, tapped directly from the line. No change in the basic fuel injection system is required.
3. **A wide variety of gas fuels are suitable,** including natural gas, butane or butane-propane mixture—whichever is available at lowest cost.

To get the most for your power dollar investment, write today for full information on these and other outstanding features of Enterprise Dual Fuel Engines.

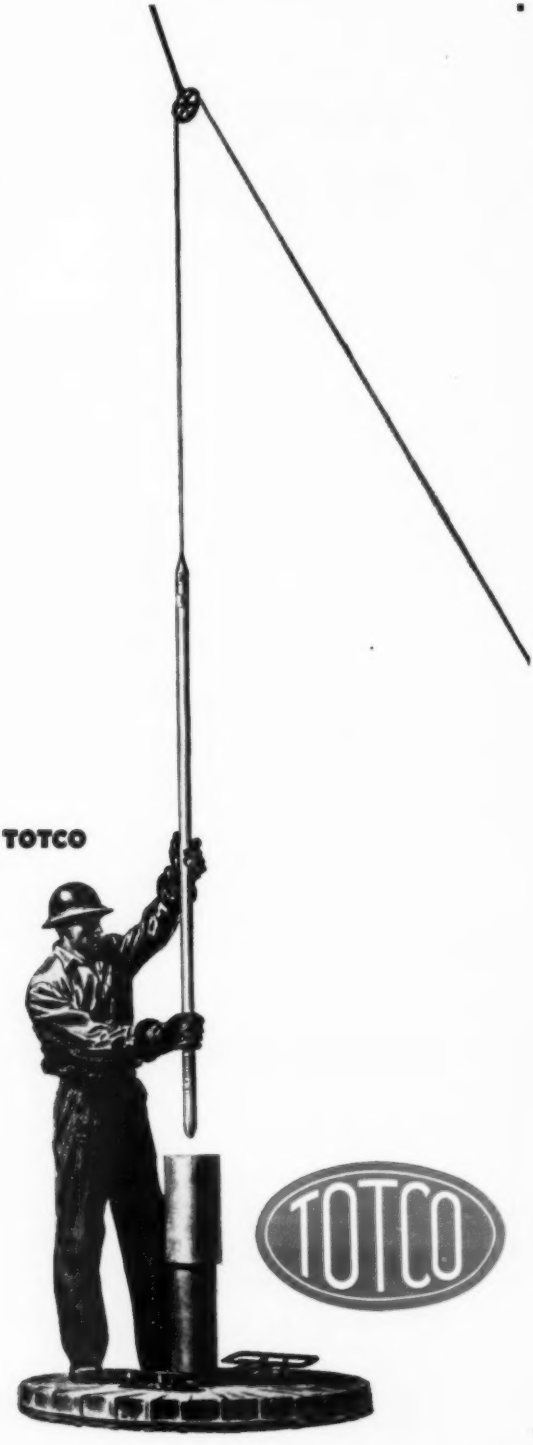
ENTERPRISE
Dual Fuel Engines

Enterprise DEPENDABLE Diesels

Enterprise Diesels, Dual-Fuel and Spark Ignition Gas Engines are built in a wide range of models from 68 to 1755 HP, Generator sets to 1250 KW. Turbocharging available on most models.

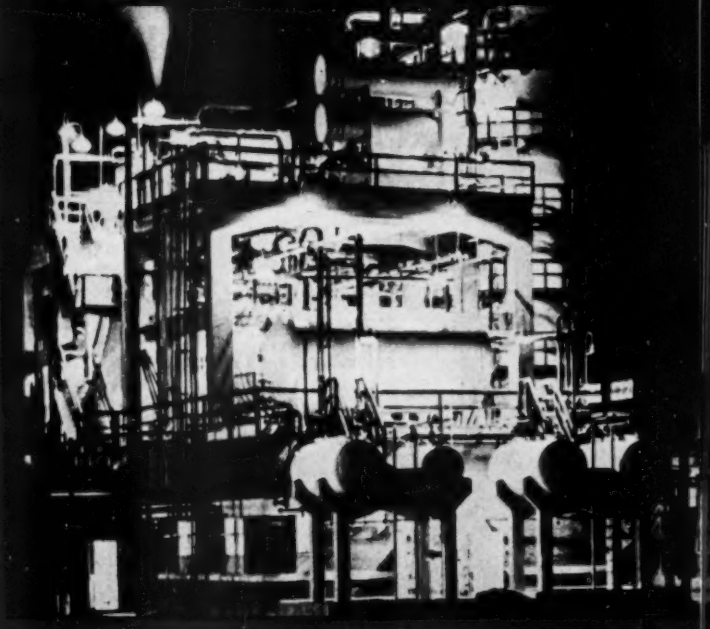
ENTERPRISE ENGINE & MACHINERY CO.
A Subsidiary of General Metals Corporation
18th & Florida Streets, San Francisco 10, California
Offices in Principal Cities

Be **SURE** *you know, use* **TOTCO**



Now

Blaw-Knox brings its services a thousand miles nearer to the great Southwest



T

- Gasoline Plants
- Package Gasoline Stripping Plants
- Compressor Stations
- Dehydration Plants
- Pipeline Pumping and Gas Plants
- Chemicals from Refinery Gases
- Special Refining Processes
- Plant Surveys
- Re-cycling Plants
- Gas Cleaning Equipment
- Catalytic Cracking Plants

CHEMICAL PLANTS DIVISION

BLAW-KNOX CONSTRUCTION COMPANY

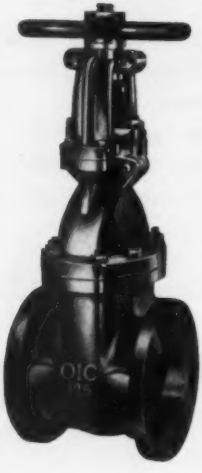
PITTSBURGH, PENNA. • TULSA, OKLAHOMA

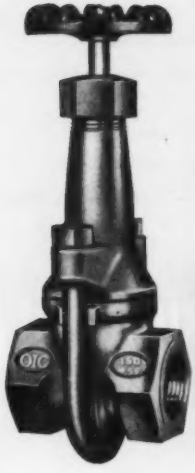
OIC FOR

GATES, GLOBES, ANGLES, CHECKS
There's this long line to choose from . . .

BRONZE

⅛-inch to 3-inches
125S, 150S, 200S, 300S, 350S, 300A, 200, 400, 2000 & 2500WOG.



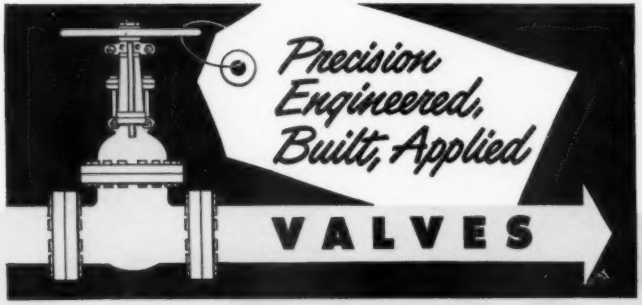


IRON

1¼-inch to 16-inches
125S, 150S, 250S, 175, 200, 400 & 500 WOG.
CLIP GATES—¼-inch to 4-inches.

OIC
FOUNDED 1883

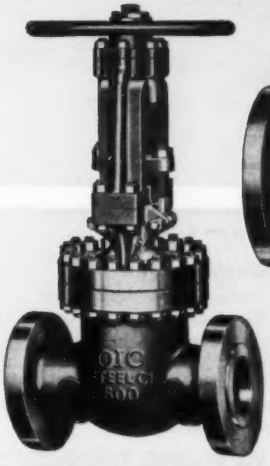
ANY VALVING REQUIREMENT



FORGED STEEL

CAST STEEL

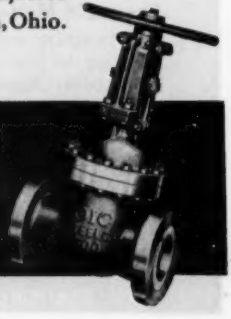
¼-inch to 2-inches
600 primary pressure series.



2 inches to 16 inches
150, 300 and 600 primary pressure series.

Screwed, flanged, butt weld and socket weld ends . . . rising and non-rising stems . . . outside screw and yoke . . . alloy metal seats, discs and wedges, composition discs . . . union, inside screw and bolted bonnet . . . tapered and parallel seat wedges.

If you're needing valve application know-how, call the nearby OIC distributor or write direct to us. The Ohio Injector Company, Wadsworth, Ohio.



VALVES

FORGED AND CAST STEEL • IRON • BRONZE

IF YOU ARE AN OLD TIMER...

If you are an old timer in the oil fields, you have probably used Thermoid Powerflex Rotary Hose for many years. And we don't need to tell you that the name "Thermoid" on any product is a sure sign of dependability. But we would like to remind you of the time and labor saving qualities of these two Thermoid Hoses:

Thermoid Mud-Flo Suction Hose
permits raising and lowering of suction pipe and changing the position of intake without changing connections. Reinforced with heavy galvanized round wire imbedded in the walls to prevent collapse and permit unobstructed flow.

Thermoid Flexible Discharge Hose
speeds rig-up and tear-down time between mud-pump and standpipe. Eliminates vibration that causes loosened connections, and avoids sharp angles that cause pressure loss and turbulence. Full flow couplings securely anchored for the life of the hose. Steel cables provide maximum flexibility—every length pre-tested to 5000 psi.

As always, it will pay you to specify Thermoid.

Mid-continent Office and Warehouse: Houston, Texas

SEE OUR CATALOG IN THE COMPOSITE CATALOG

Powerflex Rotary Hose • Trioflex Slim-Hole Rotary Hose • Mud-Flo Slush Pump Hose • Flexible Discharge Units • F.H.P. and Multiple V-Belts • Oil Country Flat Belting

Thermoid

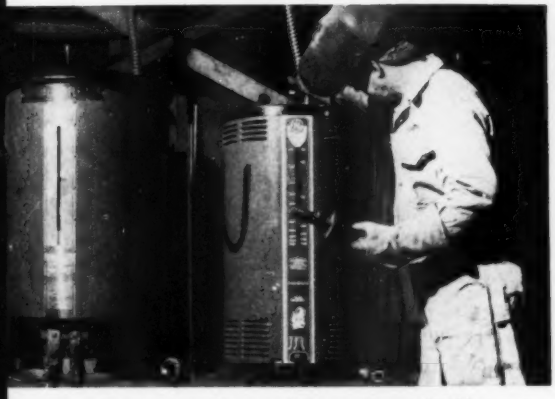
Wire Line Turn Backs • No-Wip Line Savers • Stuffing Box Rings • All Types of Hose • Molded Specialties • Brake Blocks

Thermoid Company • Offices & Factories: Trenton, N. J., Nephi, Utah

Here, Alco welders help meet production schedules on locomotive frames, vital to defense, by using G-E a-c welders. AC welders eliminate troublesome arc-blow encountered when welding high-tensile steels with d-c equipment.

100% A-C WELDED!

Here's How Alco Produces Road Locomotive Frames with G-E Welders



Shown above are two of the many G-E a-c welders used at Alco.

Corners can be difficult to weld, but the absence of troublesome arc-blow with G-E a-c welders enables this operator to lay an even corner bead in any position.

Diesel-electric road locomotive frames are 100% a-c welded at the Schenectady, N. Y., plant of American Locomotive Company. Alco welding engineers report that General Electric a-c welders eliminate troublesome arc-blow, make for easy striking, cost less than d-c, use less power and are easily maintained.

Like the American Locomotive Company, you may also find that you can speed production by using G-E a-c welders. For example . . .

YOU CAN WELD BETTER WITH AC

You have complete control of the arc in all positions because G-E a-c welders eliminate troublesome arc-blow. This reduces the danger of undercutting and slag inclusions and produces better welds.

YOU CAN WELD FASTER WITH AC

In almost every case you can use higher currents and larger electrodes. That means more footage. Users report increases of 10 to 50%.

YOU CAN WELD AT LOWER COST WITH AC

G-E a-c welders cost less than d-c equipment of the same rating. They use only one-fourth as much power when idling and have much lower load losses. And because there are no rotating parts, maintenance is practically negligible.

SEE YOUR G-E WELDING DISTRIBUTOR!

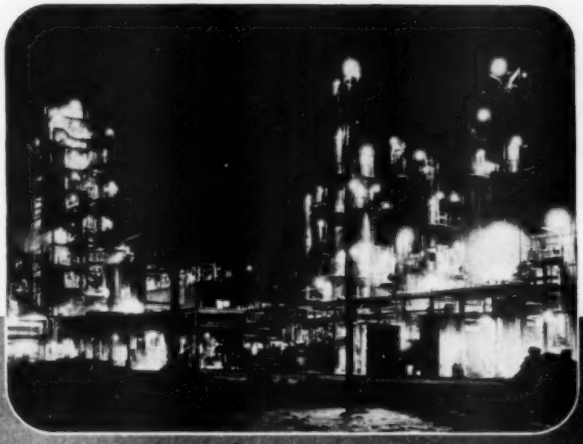
He's listed in the yellow pages of the telephone directory. Just look for General Electric under "Welding Equipment." Your distributor carries a complete line of welders, accessories and electrodes. General Electric, Schenectady 5, N. Y.

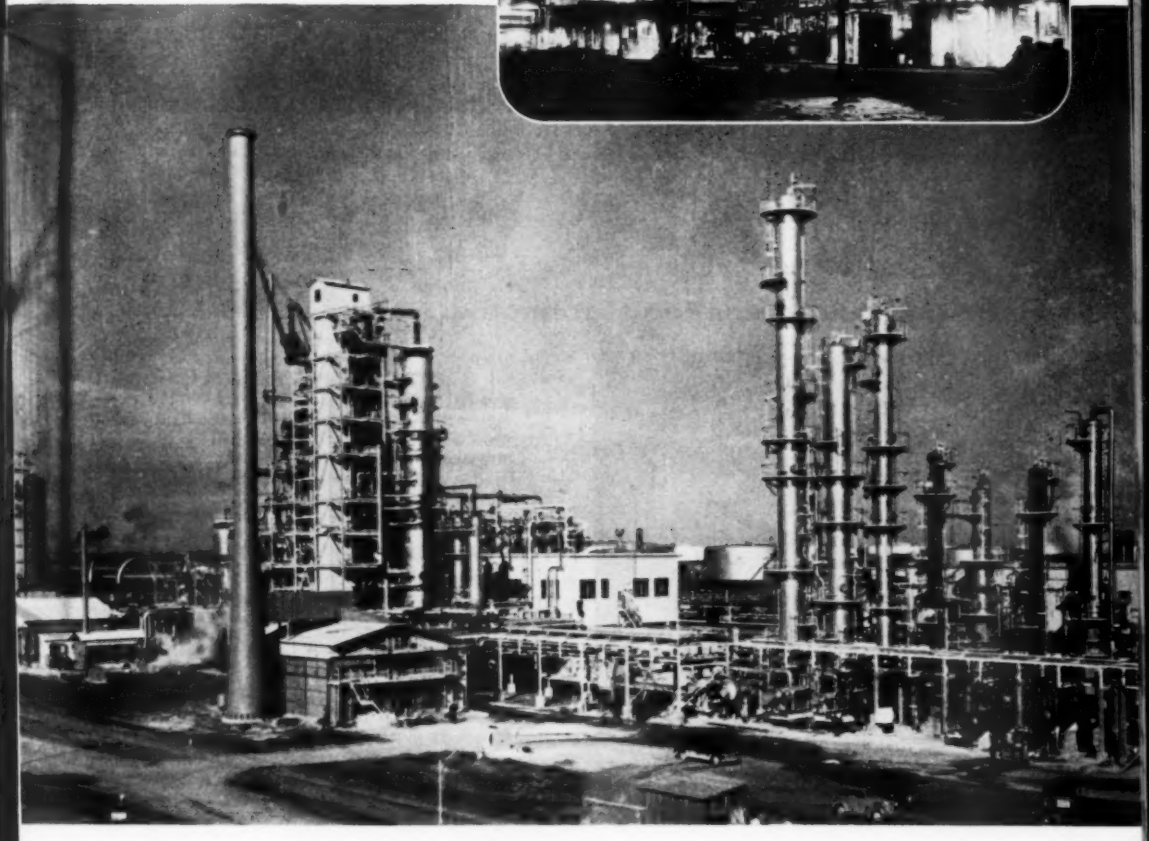
GENERAL ELECTRIC

711-17

NEW CAT CRACKER BY McKEE

● Engineering and construction of this compact new Catalytic Cracker and its integrated facilities were recently completed by Arthur G. McKee & Company for Shell Oil Company of Canada, Limited.





DESIGN, ENGINEERING AND CONSTRUCTION FOR THE PETROLEUM REFINING AND IRON AND STEEL INDUSTRIES

McKee Engineering

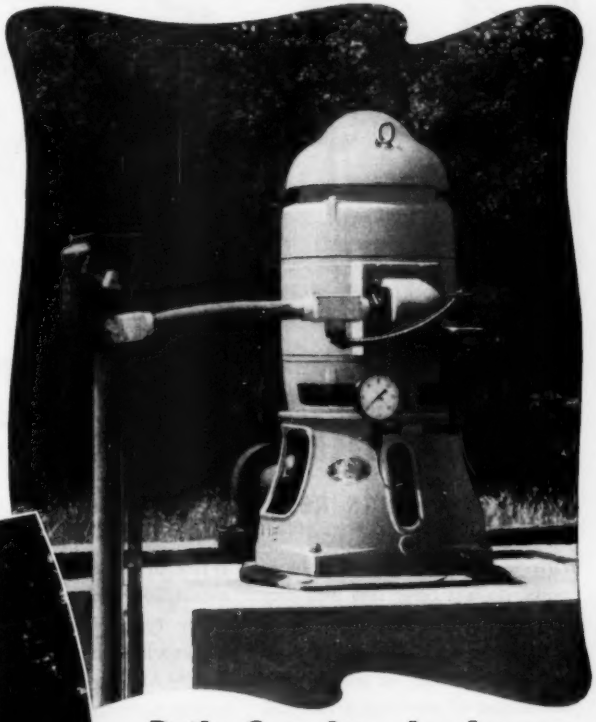
Arthur G. McKee & Company • Established 1905

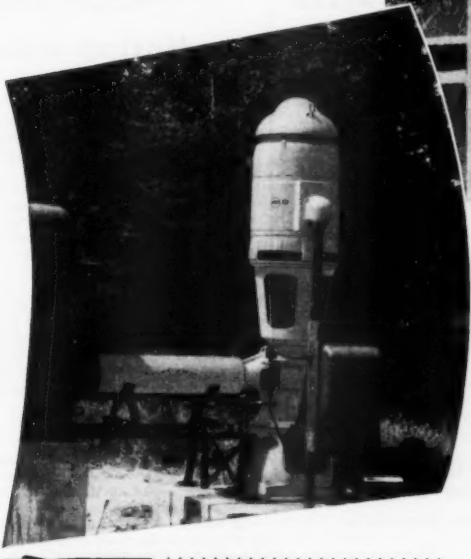
Headquarters: McKee Building, 2300 Chester Avenue, Cleveland 1, Ohio. *New York:* 30 Rockefeller Plaza, New York 20, N.Y. *Tulsa:* 918 First National Bank Building, Tulsa 3, Okla. *England:* The Iron and Steel Division of Arthur G. McKee & Company, is represented by Head, Wrightson & Co., Ltd.

INSTALLED FOR THE CITY OF

TOMS RIVER, New Jersey

. . . WITH her population more than doubling during the summer season, the resort city of Toms River, New Jersey, was facing a serious water shortage problem. Five old, inefficient and not too dependable wells were being operated with suction pumps. Layne was called in for a discussion of what could be done with limited funds. Layne's recommendations resulted in a contract for the rebuilding and re-equipping of one old well and the drilling and equipping of a new one. The contract also called for equipping one pump with an auxiliary, gasoline engine drive, on one of the pumps, for use in case of electric power failure. Without delay everything was finished according to the contract, giving the city of Toms River a water supply that more than fulfills present needs. The new equipment also greatly reduced operation cost which more than justified the investment.





Built Complete by Layne

Everything, with the exception of some wiring for the Toms River job was handled complete by Layne in one inclusive contract. Each phase of the work was under the supervision and direction of Layne engineers who made sure that all materials and method of installation were up to Layne's very exacting standards. The entire job handled in one contract was an important factor in saving time, extra expense and unnecessary worry for the Toms River city officials. Furthermore it assured the city of obtaining a completely satisfactory job throughout.

LAYNE & BOWLER, INC.
General Offices, Memphis 8, Tenn.

★★★★★★★★★★★★★★★★★★★★★★★★★

Catalog on Layne
WELL WATER SYSTEMS

Fifty-two pages of highly interesting and fully illustrated details on the Layne method of building the world's finest well water systems. Shows pictures of many installations for cities, factories, pipe lines, petroleum refineries, etc. Sent without obligation.

★★★★★★★★★★★★★★★★★★★★★★★★★

Layne
WATER SUPPLY
WELLS & PUMPS

AIRCO HARDFACE-LIFTING

makes old parts new... and new parts better

With today's delays in replacements, dollars offer less and less protection when tools or equipment wear out. No chance of cut-backs, or loss of day-to-day production, if wearing areas are fully protected with Airco Hardfacing Alloys... new parts and old stay on the job longer—even at peak production.

No matter what the part, or tool ... fishtail bits ... roller bits ... core heads ... wall scraper blades ... drag type drilling bits ... their life is extended many times by using Airco Tung Tube.

There are more than fifteen types of Airco Hardfacing rods available ... for protection from every type of wear. Two other alloys widely used in oil field service are Aircoloy 1 and 6, for hardfacing equipment to resist corrosion and temperatures above 700°F. Both alloys have been built to resist abrasion at high temperatures.

Wear is a serious problem in your operations! It will pay you to investigate Airco Hardfacing Alloys. An Airco representative will be glad to give you complete information. Get in touch with your local Airco office today.

a few

AIRCO

hardfacing alloys

AIRCOLOY® No. 1

A non-ferrous, hardfacing alloy consisting of cobalt, chromium and tungsten ... excellent corrosion resistance ... retains hardness and wear resistance even at red heat ... cold hardness of 53 to 57 on Rockwell "C" scale. May be used wherever heat, abrasion and corrosion are involved. Aircoloy No. 1 is furnished bare for oxyacetylene application and coated for electric arc welding.

AIRCOLOY® No. 6

Excellent corrosion resistance ... high impact and good wear resistance with some degree of ductility ... retains hardness and wear resistance at red heat ... cold hardness of 43 to 47 Rockwell "C". May be used wherever heat, impact, abrasion and corrosion are involved.

AIRCOLITE No. 59

These cast alloy rods are recommended for application wherever abrasion resistance is particularly important. Deposits acquire a high polish in service, and maintain their high hardness at temperatures up to 800° F. Applied either electrically or by gas process. Deposits test from 54-59 on Rockwell "C" scale.

★ ★ ★

Air Reduction supplies Oxygen, Acetylene and other industrial gases ... Calcium Carbide ... and a complete line of gas cutting machines, gas welding apparatus and supplies, plus arc welders, electrodes and accessories. Ask us about anything pertaining to gas welding and cutting and arc welding ... we'll be glad to help you.

AIRCO

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REPRESENTED INTERNATIONALLY BY AIRCO COMPANY INTERNATIONAL
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THE FIRST AND ONLY WIRE ROPE OIL FIELD HANDBOOK

FOR DRILLERS

WITH COMPLETE TON-MILE TABLES by WICKWIRE

No Figuring... No Computing... In Measuring Wire Rope Ton Mileage.
Just look it up in the Wickwire Handbook.

Wickwire's new oil field handbook gives you 112 pages of valuable, factual information on correct wire rope usage in oil field drilling—including field-proven Wickwire cutting-off practices.

AND SOMETHING ENTIRELY NEW

. . . over 50 pages of ton-mile tables (pipe size 2⅞" to 5½") that enable you to measure wire rope ton mileage . . . quickly and simply without complicated figuring. The Wickwire handbook can help you avoid costly line breaks . . . save you money by eliminating excessive cutting-off . . . makes it possible for you to determine with greater accuracy the proper time to cut off drilling lines.

FOR YOUR FREE COPY...
FILL IN COUPON BELOW

Wire Rope Dept.
Wickwire Spencer Steel Division of C. F. & I.
Palmer, Mass.

Please send me free copy of your new Oil Field Handbook with Ton-Mile Tables.

Name_____

Company and Position_____

Address_____

City and State_____

THE COLORADO FUEL & IRON CORPORATION—Abilene (Tex.) • Denver
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THE CALIFORNIA WIRE CLOTH CORPORATION—Los Angeles • Oakland
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WICKWIRE ROPE
CF&I

Stronger . . . safer . . . and money-saving, too!

CHEVROLET Advance Design TRUCKS

Strength to carry your loads . . . power to *move* your loads and *keep* moving them . . . extra features that add up to more service, safety, operating comfort and economy! These new Chevrolet trucks offer you more of the things that count on the job . . . more of the money-making, money-saving features you want and need on jobs that test a truck's real value. Check what Chevrolet trucks offer and see for yourself. Valve-in-head engines that squeeze more power from every drop of gas. Self-energizing brakes for extra stopping power—greater safety. Wide-base wheels for increased tire mileage. These new Chevrolet trucks even offer extra driver comfort—with new cab seats and Ventipanes. But learn all the facts now. See the new Chevrolet Advance-Design trucks at your dealer's today.

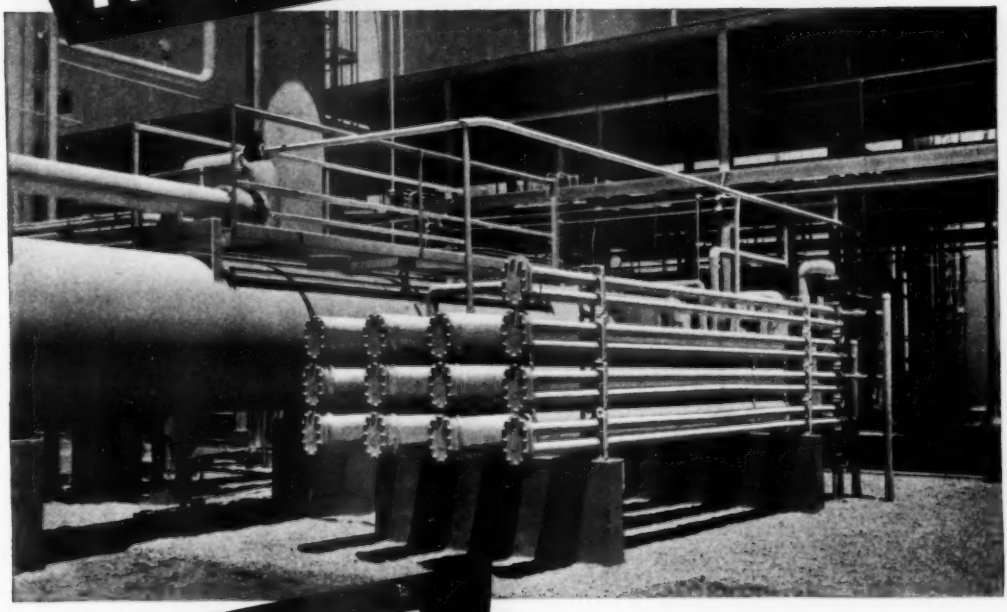
CHEVROLET DIVISION OF GENERAL MOTORS, DETROIT 2, MICHIGAN

CHEVROLET

ADVANCE-DESIGN TRUCK FEATURES

TWO GREAT VALVE-IN-HEAD ENGINES—the 105-h.p. Loadmaster or the 92-h.p. Thriftmaster—to give you greater power per gallon, lower cost per load • **POWER-JET CARBURETOR** — for smooth, quick acceleration response • **DIAPHRAGM SPRING CLUTCH**—for easy-action engagement • **SYNCHRO-MESH TRANSMISSIONS** — for fast, smooth shifting • **HYPOID REAR AXLES**—for dependability and long life • **NEW TORQUE-ACTION BRAKES**—for light-duty models • **PROVED DEPENDABLE DOUBLE-ARTICULATED BRAKES** — for medium-duty models • **NEW TWIN-ACTION REAR BRAKES** — for heavy-duty models • **NEW DUAL-SHOE PARKING BRAKE** —for greater holding ability on heavy-duty models • **NEW CAB SEATS**—for complete riding comfort • **NEW VENTIPANES** — for improved cab ventilation • **WIDE-BASE WHEELS**—for increased tire mileage • **BALL-TYPE STEERING**—for easier handling • **UNIT-DESIGN BODIES**—for greater load protection • **ADVANCE-DESIGN STYLING**—for increased comfort and modern appearance.

Assure Flexibility in your plant



with **BROWN FINTUBE** *sectional hairpin heat exchangers*

● You'll get almost unlimited flexibility to meet changes in duties, plant re-arrangements, etc., with Brown Fintube Sectional Heat Exchangers. By simply adding a few sections to your existing exchangers, or removing a few sections, or changing the series-parallel manifolding, change-overs can be made easily and quickly. You can be operating ***efficiently*** on almost any new or different duty, on short notice, with a minimum of expense for new equipment, and without obsoleting any of your former facilities.

For utmost efficiency and economy use Brown Fintube Sectional Heat Exchangers throughout your plant. ***Write for Bulletin No. 481.***

THE BROWN FINTUBE CO.

Elyria, Ohio

Sectional Hairpin Heat Exchangers
Tank Suction and Line Heaters
Fintube Heaters for Bulk Storage Tanks
Indirect Process Air Heaters
Fintube Heaters for Processing Tanks
Integrally Welded Fintubes for Any Heating, Cooling or Heat Transfer Service

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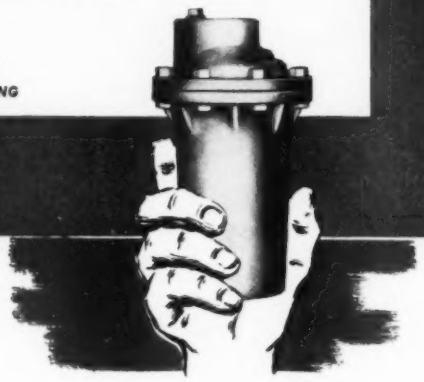
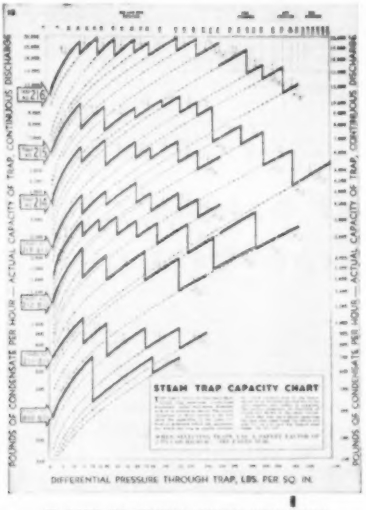
Only actual hot condensate capacities give a true picture of steam trap value

YOU KNOW THE CAPACITY WHEN YOU BUY AN ARMSTRONG




STEAM TRAP CAPACITY CHART
POUNDS OF CONDENSATE PER HOUR — ACTUAL CAPACITY OF TRAP, CONTINUOUS DISCHARGE
DIFFERENTIAL PRESSURE THROUGH TRAP, LBS. PER SQ. IN.

IT PAYS TO KNOW BEFORE YOU BUY!

THE ARMSTRONG STEAM TRAP CAPACITY CHART is based on hundreds of tests with hot condensate. You can depend on its accuracy.

SEE OUR CATALOG IN SWEETS OR CEC

THEORETICAL calculations fail entirely to give a true picture of trap capacity. Orifice tests fail to account for capacity losses caused by pipe friction. Tests with cold or warm water do not take into consideration the capacity-reducing effect of flash steam. Only tests with actual trap hookups handling hot condensate will tell you the true continuous discharge capacity of a steam trap—and those are the capacities Armstrong gives you.

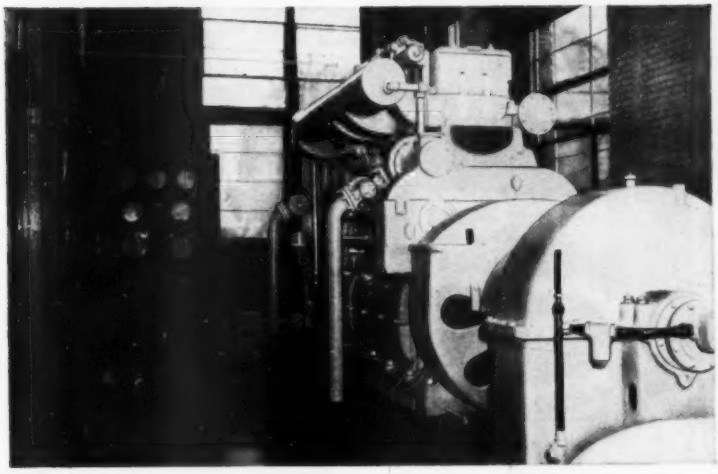
If capacities are misleading you may buy a trap too small for the job. Or, if you compare different makes of traps on a price basis you must know if they are comparable on a capacity basis or the comparison means nothing.

Dollar for dollar and size for size Armstrong steam traps give you greater capacity—another reason why they are your wisest buy. Your nearby Armstrong Representative can supply you. Call him for recommendations.

ARMSTRONG MACHINE WORKS
863 Maple Street • Three Rivers, Michigan

The 36-PAGE STEAM TRAP BOOK gives Armstrong trap capacities and tells how to select the right size trap for every job. Ask for a copy.

ARMSTRONG STEAM TRAPS



21,716 hours without forced shutdown

...and still going strong

that's the record of this Alco Diesel Engine at Barnett Station of Shell Products Pipe Line

Listen to Mr. C. C. Curvey, chief operator at Barnett, Ill., speaking:

"The unit operates 24 hours a day and is never shut down except for the annual routine inspection and overhaul. . . . Not only have we boosted capacity of this line 15%, but operating and maintenance costs have been much reduced."

The Barnett station is equipped with a single Alco diesel—replacing a total of 3 old-type engines. This rugged Alco diesel provides power for pumping 1,050,000 barrels a month through the 8-inch pipe line. It's a 6-cylinder, 4-cycle engine with 12½ inch bore and 13 inch stroke, rated at 810 hp and 650 rpm. Such power and performance can be yours, too, if you install Alco Diesel Engines to meet your pipe line pumping requirements. Your nearest Alco engineer will be glad to help. Call him today at sales offices in New York, Beaumont, Chicago, Cleveland, Houston, Kansas City, San Francisco, Schenectady, St. Louis.

SPEED Vs. WEAR

Remember, since piston speed and journal travel per minute are both almost the same in medium speed and slow speed engines, wear is equivalent as well. Not only do you get unequalled dependability with Alco Diesels—you get long wear and low maintenance costs, no matter how difficult the service conditions.

ALCO DIESELS

THE MARK OF MODERN ENGINEERING

AMERICAN LOCOMOTIVE COMPANY

two heads

ARE BETTER THAN ONE!

One head, with single totalizer, was "good enough" in the early days of liquid metering. But today's demands for greater accuracy and modern accounting methods require *two heads.* One counter registers gross gallons; the second records gallons corrected to a true volume at 60°F. base.

The *Dual Head Adaptor* is *another first* for A. O. Smith in its development of *functional* meter accessories. A boon to accounting, it permits you to dispense gross gallons and keep your inventory on a net gallon basis. See nearest SMITHway dealer for complete information. Write for Bulletin No. *125.*

77th ANNIVERSARY 1876 · 1953

DEPENDABILITY THROUGH RESEARCH AND ENGINEERING. To Petroleum Meters, the Meter Division of A. O. Smith devotes the same high standards of research and engineering which have distinguished all of the products of this firm for 77 years.

DUAL HEAD ADAPTOR includes two counters, one indicating "gross" gallons and the other "net" gallons or true volume at 60°F. Illustration shows No. 314 Large Numeral Counter and Ticket Printer recording sales on gross gallon basis and No. 104 non-reset counter totalizing thru-put at 60°F. Any counter may be used on either gross or net basis.

A.O.Smith

METER DIVISION

FACTORIES: 5715 SMITHWAY STREET, LOS ANGELES 22, CALIF. • P.O. BOX 500, SUSQUEHANNA, N.J.

Offices: New York, Chicago, Houston. Canada—Toronto, Vancouver.
International Division—Milwaukee 1, Wisconsin.

In 2-way radio

G.E. MAKES MORE OF ITS COMPONENTS THAN ANY OTHER MANUFACTURER!

THIS is important to users of 2-way radio because it means you get a complete General Electric product from the chassis up . . . tubes, transformers, dynamotors, crystals, capacitors—all designed, engineered, and manufactured by G. E. to insure rigid quality control and a superior product.

But quality alone is not enough. More General Electric 2-way radio equipment was bought last year than in any similar period in the company's history. To meet this growing demand a new plant has been established at Utica, N. Y., devoted exclusively to the manufacture of our complete radio communication line.

When you buy a 2-way radio system, consider the years of service you expect to get out of it. Examine all makes—then put your money into lasting quality, backed by a name you can believe in—General Electric.

- **TUBES**—Receiver types and transmitter types—made at G-E plants at Owensboro, Kentucky, and Schenectady, New York.
- **TRANSFORMERS AND CHOKES**—Two mighty important reasons why G-E station transmitters are rated for continuous duty cycle. Made by General Electric at Fort Wayne, Indiana.
- **SPEAKERS**—With the famous aluminum voice coil for all-weather performance. Made at Electronics Park, Syracuse, N. Y.
- **DYNAMOTORS**—Another G-E product from Fort Wayne. They're built for 100,000 starts!
- **PYRANOL CAPACITORS**—The last word in component dependability. A G-E specialty from Pittsfield, Mass.
- **WIRE & CABLE**—From the Bridgeport Works of G. E.

WHAT A PERFORMANCE PACKAGE—HERE'S WHAT YOU GET!

Selectivity in a class by itself—new 4-coil IF transformers . . . minimum intermodulation and high image ratio . . . sensitivity that stays up even when the battery's down . . . lower tube replacement cost and lower standby battery drain than other makes. It's the best 2-way radio performance your dollar can buy!

General Electric Co., Sec. 8101-4
Electronics Park—Syracuse, N. Y.

Yes, send me your FREE INFORMATION KIT on General Electric 2-way radio equipment.

NAME .....

ADDRESS .....

CITY ..... STATE .....

You can put your confidence in—

GENERAL ELECTRIC

This is Why the Nash is the Most Simple Compressor

It's the Nash!

There are no mechanical complications in a Nash Compressor. A single moving element, a round rotor, with shrouded blades, forming a series of buckets, revolves freely in an elliptical casing containing any low viscosity liquid. This liquid, carried with the rotor, follows the elliptical contour of the casing.

The moving liquid therefore recedes from the rotor buckets at the wide part of the ellipse, permitting the buckets to fill with gas from the stationary Inlet Ports. As the casing narrows, the liquid is forced back into the rotor buckets, compressing the gas, and delivering it through the fixed Outlet Ports.

Nash Compressors produce 75 lbs. pressure in a single stage, with capacities to 6 million cu. ft. per day in a single structure. Since compression is secured by an entirely different principle, gas pumping problems difficult with ordinary pumps are often handled easily in a Nash.

Nash simplicity means low maintenance cost, with original pump performance constant over long periods. Data on these pumps sent immediately on request.

No internal wearing parts.

No valves, pistons, or vanes.

No internal lubrication.

Low maintenance cost.

Saves floor space.

Desired delivery temperature automatically maintained.

Slugs of liquid entering pump will do no harm.

75 pounds in a single stage.

NASH ENGINEERING COMPANY
322 WILSON, SO. NORWALK, CONN.

for

FLASHING SPEED or SUSTAINED SERVICE

AMERICAN BOSCH MAGNETOS

Wherever dependable spark ignition is needed—for flashing speed in the air or on the speedway . . . or for rugged, sustained operation in oil field, construction or farm service, you'll naturally find American Bosch Super-Powered Magnetos on the job. These world-famous Magnetos deliver the faultless spark ignition and unerring reliability you look for in your equipment. Because they stand up under the heaviest loads and give long, economical work-life, regardless of the type or severity of service, many leading engine builders choose American Bosch Magnetos as original equipment.

Whatever your magneto requirements may be, American Bosch can provide the practical answer for outstanding ignition service. American Bosch Super-Powered Magnetos are available in various types and sizes for engines large and small —special low-tension models for large stationary gas engines. Ask us for the facts today.

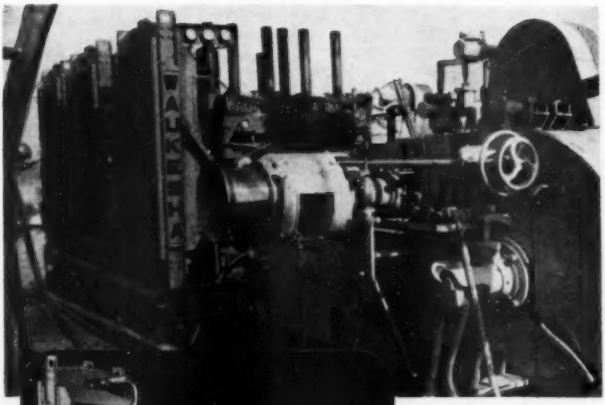
Said Lee Wallard, the winner of this year's big "500" Indianapolis Speedway Race . . . "Sure happy I won today's 500 mile classic. The American Bosch MJL Magneto on my Belanger Special never missed a beat all the way. It's a champ."

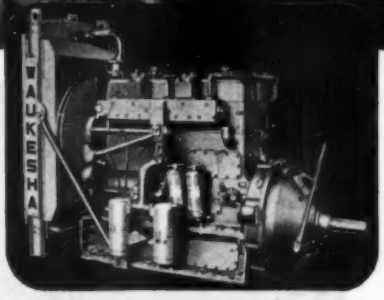
American Bosch

MAGNETOS • GENERATORS • VOLTAGE REGULATORS • IGNITION COILS
ELECTRIC WINDSHIELD WIPERS • DIESEL FUEL INJECTION EQUIPMENT

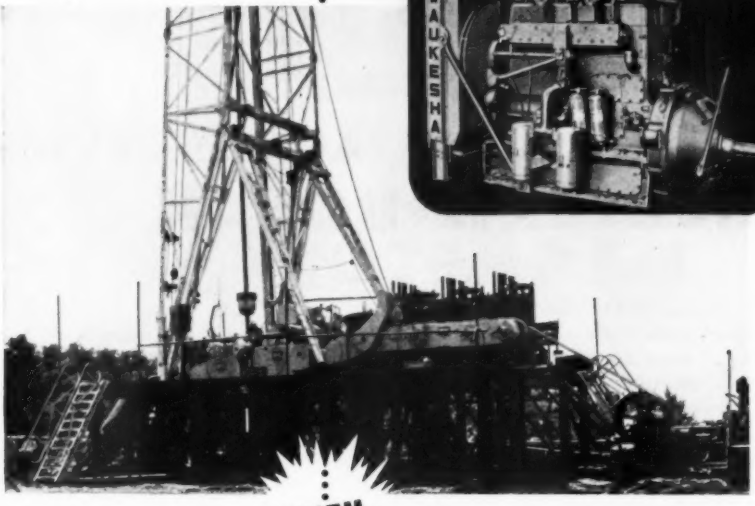
AMERICAN BOSCH CORPORATION • SPRINGFIELD 7 • MASS.

DRILLING goes faster DOLLARS go farther





WAUKESHA 6-NKU Oil Field Power Units —six cylinders, 7-in. bore x 8½-in. stroke, 1962 cu. in. displ.; 225 peak hp at 1050 rpm, or 173 hp continuously at 950 rpm on natural gas or butane.



Cushing, Oklahoma—the **Unit Drilling Co.** is using **Unit-Rig** (upper and lower pictures) powered by three **Model 6-NKU Waukesha Oil Field Power Units** (shown in center picture).

WITH

WAUKESHA

OIL FIELD POWER

If they didn't make more hole with Waukeshas, you wouldn't find so many of 'em all through the oil fields. Right here, the three Waukesha Gas Power Units are Model 6-NKU. The fast, flexible engine pours on the power—smoothly and dependably—the deeper the drilling. And it can take sudden, momentary overloads, without stalling. With its overhead valves and renewable wet sleeve cylinders, and all major parts easily accessible, it is simple and inexpensive to service. Effectively cooled by the large, separate radiator, and fan, as well as its jacketed exhaust outlets. It also has a 3¾-inch 7-bearing crankshaft, full floating piston pins and full pressure oiling. It's a great unit for well servicing or work-over duty, or any oil field or refinery service. Get Bulletins 1136 and 1122.

Waukesha Engines and Power Units—15 hp. to 500 hp.—for every oil field service

145

[redacted] **WAUKESHA MOTOR COMPANY, WAUKESHA, WIS.** [redacted]

NEW YORK • TULSA • LOS ANGELES

WE DO THE *spadework..*

THE thorough-going procedures of the field crews, the competency of the party chiefs, and the extensive professional experience of *every* key member of the Independent organization is the foundation on which a long list of oil producers have been building successful geophysical exploration programs for 18 years. The success of your own quest for new oil reserves depends on how well the spadework is done. It will pay you to consult with Independent about your next survey project.

N. N. Zirbel graduated from Rice Institute and started to work with Independent 18 years ago. He went through the mill learning thoroughly the function of every man on a survey party before becoming a party chief. Only men with such extensive training and field background hold posts of responsibility with Independent.

POINTING THE WAY FOR THE DRILL

IXC

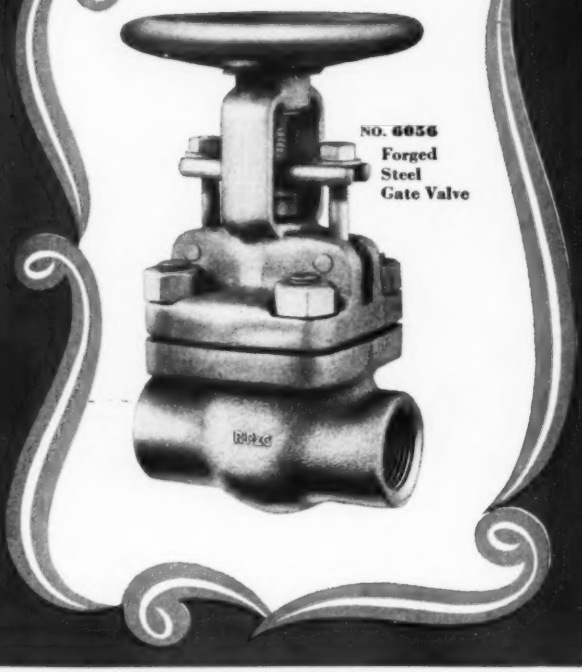
Independent *Geophysical Surveys*

EXPLORATION COMPANY

1973 WEST GRAY ★ HOUSTON, TEXAS

ESTABLISHED 1932

R·P&C VALVES



NO. 6056
Forged
Steel
Gate Valve

Here is a Premium Valve
that is NOT premium priced

CHECK THESE DESIRABLE FEATURES:

- Bolted bonnet construction
- Heat-treated and hard chrome plated stainless steel wedge
- Stainless steel gland eye-bolts and nuts
- Two-piece gland and follower
- Tongue and groove bonnet joint

It's well designed. It's low priced in its field.
See your R-P&C distributor or write nearest R-P&C district office.

ACCO

R-P & C VALVE DIVISION
AMERICAN CHAIN & CABLE

"Intentionally Better"
READING-PRATT & CADY VALVES

It Pays to Use ALLOY STEELS!

In critical times, there's no time for "down-time." Machinery and tools *must* be able to stand the gaff of "round-the-clock" operation—or production of oil will fail to keep pace with national needs.

Now, more than ever before, vital parts of drilling equipment need the stamina of alloy steels.

Republic Alloy Steels are tougher and stronger than carbon steels. *Uniform* response to heat-treatment gives these rugged steels hard, wear-resisting surfaces around tough, fatigue-resisting cores. They offer high resistance to temperature extremes, corrosion, severe strain, shock and reversal of stress—all-around ability to stand up in deep drilling operations.

Yes, when machinery can't rest, alloy steels are best. They'll lessen the danger of costly breakdowns, and lengthen the time between parts replacement.

Republic—world's largest producer of alloy and stainless steels—offers its 3-Dimension Metallurgical Service to help you determine where these versatile steels can do a better job on your operation. Write, phone or wire today.

REPUBLIC STEEL CORPORATION
Alloy Steel Division · Massillon, Ohio
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, N.Y.

Republic ALLOY STEELS

REPUBLIC STEEL

Other Republic Products include Casing—Tubing—Line Pipe—Upson Studs, Bolts, Nuts and Rivets—Electrunite Boiler Tubes

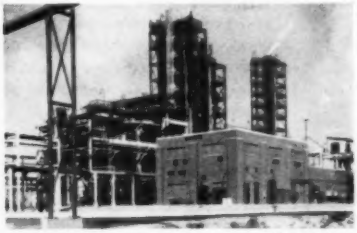
THE MONEY MRS. CABANIS and her fellow stockholders have invested makes possible the average of $31,400 in tools and equipment back of each Standard Oil worker which helps him to produce more, earn more and have steadier work. The public benefits, too, by being assured of a dependable supply of quality petroleum products.

"I am Mrs. John Cabanis of Mason City, Iowa.

Two years ago, my picture appeared in an advertisement, with the pictures of eleven other of the owners of Standard Oil and its subsidiary companies. Besides my name and address, all the ad said about me was that I am a widow who has owned Standard Oil stock for many years, and that the dividends from it helped put my son through college. Soon after the ad appeared I began receiving mail from people I'd never heard of. Some of them seemed surprised that a big company like Standard Oil is owned by a great many everyday people.

"I myself had learned from the company's annual report that there are many thousands of owners of Standard Oil, including a number of business firms and educational and charitable institutions. Most of the owners are people like me and like you. We invested our money, and as a return on this investment, Standard Oil pays us dividends. Dividends paid last year had a value of $3.14 per share. The company has paid dividends for 58 consecutive years. And, our investment is working for us and for a great many other people, too. Because of it, Standard Oil is able continually to build up its facilities for serving its customers. And it helps the company to create more and better paying jobs. It's nice to know that. It makes me feel more useful and more important—and it's a feeling that nearly everyone could share, by becoming a partner in some American business, as I am one of the more than 118,000 partners in Standard Oil."

AMONG OUR STOCKHOLDERS are many institutions—educational institutions like Coe College of Cedar Rapids, Iowa; charitable organizations, and hundreds of insurance companies and business firms. No institutional stockholder owns so much as 4% of our stock, and no individual owns so much as 1%.

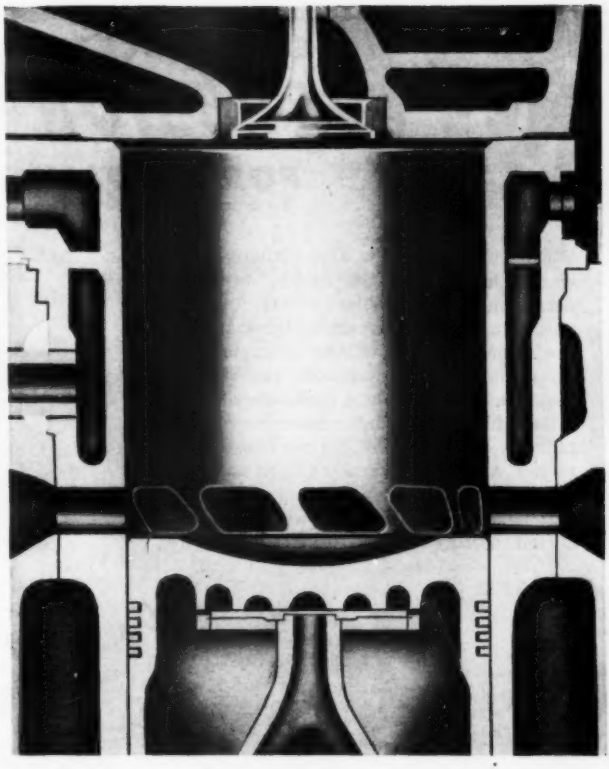


THE MONEY MRS. CABANIS and her fellow stockholders have invested makes possible the average of $31,400 in tools and equipment back of each Standard Oil worker which helps him to produce more, earn more and have steadier work. The public benefits, too, by being assured of a dependable supply of quality petroleum products.

STANDARD OIL COMPANY (INDIANA)

IT'S THE

Biggest News in Gas-Engine Compressors



The *vital* *power center*

that cuts down-time and increases efficiency in many gas and petroleum-processing services

For the first time, a vastly superior type of scavenging has been applied to compressor engines.

Worthington's timed scavenging system, built into the uniflo UTC-16, gives advantages far beyond any previous method.

A Thoroughgoing "Clean Sweep"

Here are some of the features of this new system concentrated in the "vital power center" illustrated above:

Complete removal of exhaust gas . . . more thorough charging with gas and air . . . positive timing for optimum combustion . . . effective supercharging . . . low operating temperature preventing carbonization . . . uniform cylinder temperature resulting in equal wall stress eliminating harmful stresses.

Many Uses . . . Many Sizes

While designed primarily as a pipeline gas-engine compressor, the UTC-16 is suitable for many other services, including: pressure maintenance on oil wells . . . in natural gasoline plants . . . in oil refineries, for solvent extraction, vapor recovery, recycling and stabilization of gases . . . in petrochemical processing of products made from natural gas under pressure . . . in many refrigeration applications.

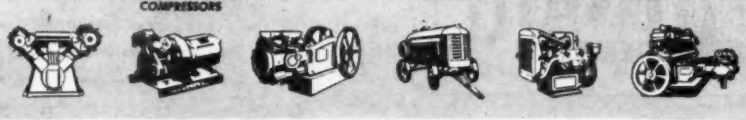
The Uniflo UTC-16 is built in sizes ranging from 800 to 2000 hp. For further proof that *there's more worth in Worthington*, contact our nearest Branch Office, or write the Worthington Pump and Machinery Corporation, Engine Division, Buffalo, N. Y.

WORTHINGTON

ENGINE COMPRESSORS

EK.1.2

NO OTHER COMPRESSOR WILL OUTPERFORM A WORTHINGTON



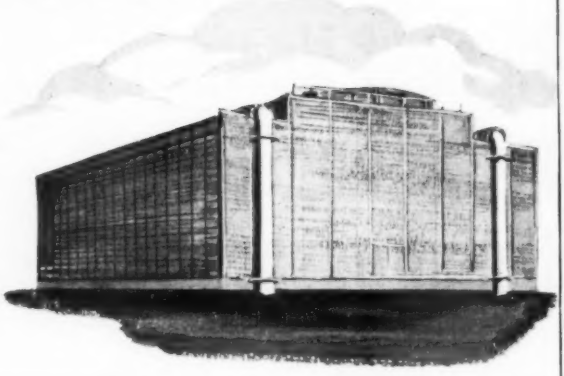
ECONOMICAL, HIGHLY EFFECTIVE

New CORROSION CONTROL

FOR COOLING TOWERS

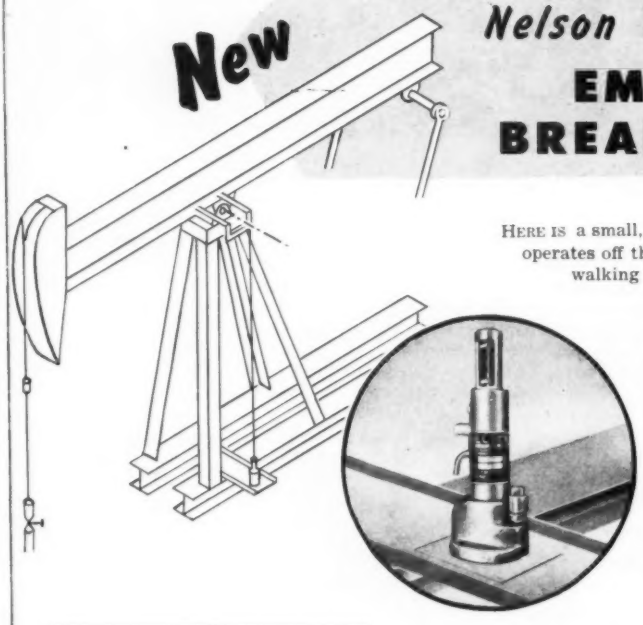
WRIGHT offers new and improved chemicals to solve the cooling tower corrosion-control problem effectively — particularly where certain contaminates are found. Because of the synergistic properties of these chemicals, excellent results are obtained at a moderate cost.

Send for complete information or contact the Wright Field Engineer closest to you. A complete survey will be made and a proposal covering our recommendations and estimated costs will be submitted to you.



New

Nelson Walking Beam EMULSION BREAKER PUMP



HERE IS a small, compact and inexpensive pump that operates off the walking beam. Each stroke of the walking beam activates the piston to inject a predetermined amount of emulsion breaker fluid into the well casing. This pump is compact with air-tight, dust-proof piston-rod packing. The stroke can be adjusted from zero to full, although the piston works to the extremity of the discharge stroke regardless of the stroke adjustment. Sizes $\frac{1}{4} \times 1\frac{1}{2}$ and larger (adjustable stroke). Displacement each delivery stroke 0.07 cubic inches. Send for bulletin.

Wright CHEMICALS

WRIGHT CHEMICAL CORPORATION

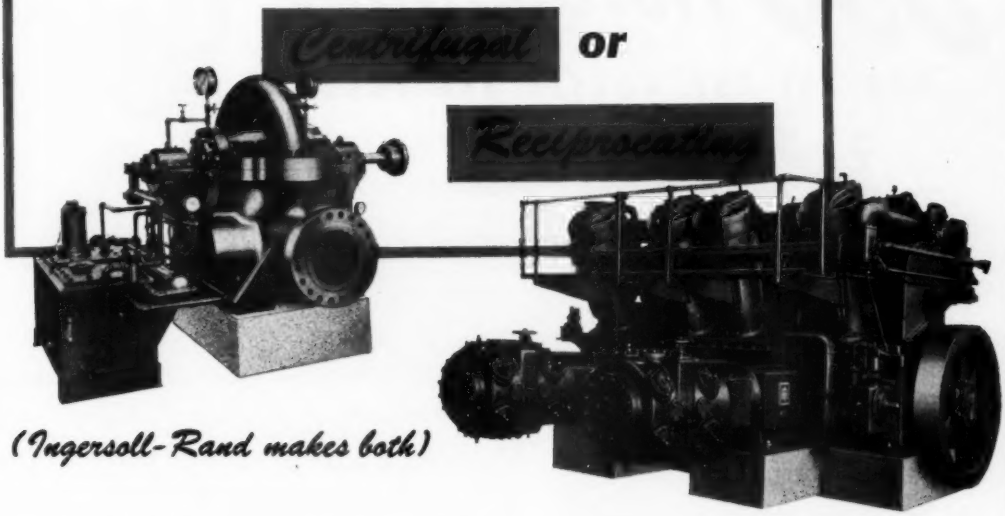
Specializing in Water Conditioning

GENERAL OFFICE AND LABORATORY—615 W. Lake Street, Chicago 6, Ill.

OFFICES IN PRINCIPAL CITIES

Sole Distributor of Nelson Chemical Proportioning Pumps

Which COMPRESSOR should you install . . . for natural gas transmission?



(Ingersoll-Rand makes both)

This is a natural question—especially in view of the tremendous amount of interest that has been stirred up by the new Ingersoll-Rand centrifugal compressors. Actually the choice between centrifugal or reciprocating compressors is always a matter of economics. There are many factors that come into the picture for any proposed installation, such as:

- Location
- Installed cost
- Cost of electric power
- Cost of steam generation
- Value of gas saved with electric drive
- Availability and cost of water
- Net pipeline capacity with different types of drive
- Station spacing and compression ratio
- Overall operating cost

HERE'S A SUGGESTION: Call in an Ingersoll-Rand engineer, he will be glad to help you make a thorough study of the economics of your proposed installation. Careful consideration of all factors involved will help you determine the type of compressor equipment that is best suited to your requirements.

COMPRESSORS · TURBO BLOWERS
PUMPS · OIL & GAS ENGINES · REFRIGERATION
ROCK DRILLS · AIR TOOLS

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y. 350-12

New WHELAND HP-14000 7½" x 14" Duplex Slush Pump

STEEL OR SEMI-STEEL FLUID END OPTIONAL

350 Horsepower

...AND ALL THE HORSES ARE THERE!

WHELAND TIE RODS. Maximum strength, minimum weight. Tie rods for extra strength are used by leading manufacturers of heavy-duty equipment such as big hydraulic and mechanical presses for forging, stamping, bulldozing. No better method has ever been found to get strength where it is most needed. Wheland uses tie rods because it is the BEST WAY to get EXTRA strength into a pump. You may have seen a lot of pumps broken in the cradle . . . but YOU NEVER SAW A WHELAND TIE ROD PUMP WHICH BROKE AT THE CRADLE.

From discharge pressure of 838 lbs. with 7½" liners to 1627 lbs. with 5½" liners at 60 R.P.M., here is the pump that delivers the mud. Wheland's exclusive power end has the strength to do the job. The fluid end, available in steel or semi-steel, is one of the best liked, best proved designs ever offered the oil driller.

This new Wheland pump is packed with features that mean extra strength, extra smoothness, more accessibility, more flexibility and great DEPENDABILITY. It's your best buy in pumps! Write for bulletin.

THE BEST POWER END EVER BUILT

The crank is the guts of any pump and here is the outstanding development . . . EXCLUSIVE WITH WHELAND. Assembled as an integral unit with NO CONNECTING ROD BOLTS. One-piece alloy steel crank on Timken Roller Bearings. Heat treated alloy steel connecting rods fitted to crank on American Roller Bearings. Tool steel helical gear and pinion, specially hardened. Ample size. Ample strength. Quiet. Free of vibration. This WHELAND pump really has the guts to do the job!

MEMBER
PETROLEUM EQUIPMENT
SUPPLIERS ASSOCIATION

WHELAND

THE WHELAND COMPANY, CHATTANOOGA, TENN., U. S. A.
ROTARY DRILLING MACHINERY

DRAWWORKS • SLUSH PUMPS
ROTARIES • CROWN BLOCKS
TRAVELING BLOCKS • SWIVELS

DOMESTIC DISTRIBUTORS & THEIR HEADQUARTERS: Jones & Laughlin Supply Co., Tulsa, Oklahoma • Houston Oil Field Material Co., Inc., Houston, Texas
Iverson Supply Co., Tulsa, Oklahoma • Lucey Products Corporation, Tulsa, Oklahoma • Superior Iron Works & Supply Co., Inc., Shreveport, Louisiana
EXPORT DISTRIBUTOR: Lucey Export Corporation, 233 Broadway, New York 7, New York — Broad Street House, London E. C. 2, England

HIEROGLYPHICS · · · *with a modern meaning*

The workman of ancient Egypt knew the symbols of his trade. They helped him fashion stone and metal, wood and cloth, into the goods and structures which best served his era. . . . The needs of our modern industrial civilization are different. Visitors to Sun Ship's mighty shops see in the making the intricate steel fabric of petroleum refineries and chemical plants . . . massive bubble towers, pressure vessels, condensers, cracking cases, and a vast array of special machinery and equipment for many industries.

But even a visitor from the days of Egypt's Pharaohs would recognize two familiar facts — that strange modern "hieroglyphics" guide precise assembly of today's steel behemoths . . . and that Sun Ship workers are masters in their knowledge of the symbols and crafts of their trades. . . . The many modern industries served by Sun know these facts, too.

Illustration at top, reproduced from "The History of All Nations," shows ancient Egyptian shipbuilding as depicted on the tomb of Ti, at Sakkara. In contrast is the 55' regenerator being built by Sun.

Sun

SHIPBUILDING & DRY DOCK COMPANY

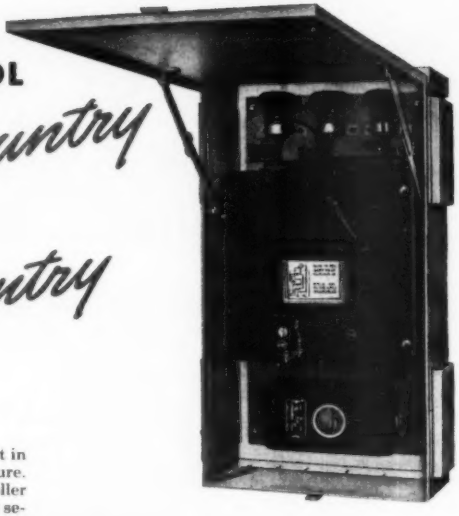
SINCE 1916

ON THE DELAWARE • CHESTER, PA.

25 BROADWAY • NEW YORK CITY

CUTLER-HAMMER

OIL WELL PUMPING CONTROL



designed in the oil country

built for the oil country

Cutler-Hammer went into the oil country to design its oil well pumping control. The thoroughness of its research is shown by the outstanding performance and preference for this controller.

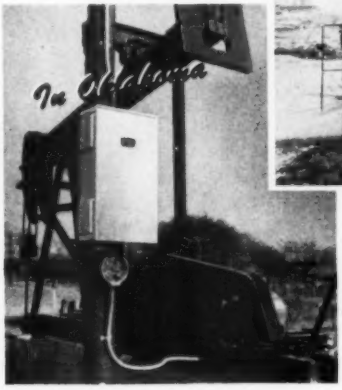
Cool operation. Intelligent ventilation, sound construction, proper design of overload heater coils, aluminum painted enclosures keep this controller *cool*. You never see a C-H Controller with its door propped open to keep it working.

Dependable performance in dust-laden air. Triple protected ventilation openings, Cutler-Hammer's exclusive vertical dustsafe contacts, a neoprene-gasketed dustproof enclosed timer and a timer clock motor with excess torque keep this controller working

Automatic staggered restarting. Although the Cutler-Hammer Controller is available *without* undervoltage relay, and *with* undervoltage relay, the most popular type has automatic restarting on a staggered schedule. Attendant doesn't have to go out in the storm after a power failure. He knows the C-H Controller will start up motors in proper sequence after such voltage failures.

Other features. Lightning arresters are the unit type. Should one blow, that fact is revealed at a glance. And you don't have to virtually rebuild the starter. Changes in pumping sequence are made in definite 15 minute increments just by pulling small accessible tabs. Resetting of clock after stoppages is made simply by turning a handy palm-size dial forward or backward. Wiring diagram, spare parts list and overload heater coil ratings are printed on a plastic-coated, dirt, grease, heat and moisture repellent sheet enclosed in each starter case.

There's dependability, ruggedness and performance plus in these Cutler-Hammer Oil Well Pump Controls. CUTLER-HAMMER, Inc., 1453 St. Paul Ave., Milwaukee 1, Wis. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto, Ontario.



OTHER CUTLER-HAMMER PRODUCTS FOR THE INDUSTRY

Bulletin 9589
Combination Starter

Across the line starter for squirrel cage motors, with side operated knife blade type disconnect switch combined in same special service enclosure. Completely wired. Saves time of installing two separate items.

Bulletin 9739
Across the Line Starter

For use with two speed consequent pole type polyphase squirrel cage motors. Form 1, selective, for pushbutton or automatic pilot device. NEMA 7 enclosure for hazardous locations.

CUTLER-HAMMER
MOTOR CONTROL
C-H

You've Heard About Bethlehem's H-150

...you're going to hear more!

Bethlehem's H-150, a pump for light rotary work, has been in the family for several months now. Long enough for almost everybody to hear about it. Long enough for drilling men to buy it and try it.

Out in the field, the only real proving grounds, the H-150 has done a swell job—for it's a sturdy, tough little unit with features reflecting the best in slush-pump engineering. Just take a look at these points:

Complete oil-bath lubrication . . . pulley extension both sides . . . all-steel fluid end . . . API metal ring gaskets on valve covers, stuffing box housing flanges, discharge flanges, strainer housing flanges . . . telltale hole protecting fluid end from washouts if packing fails . . . alloy-steel gear made from rolled seamless forging . . . alloy-steel pinion . . . roller bearings throughout.

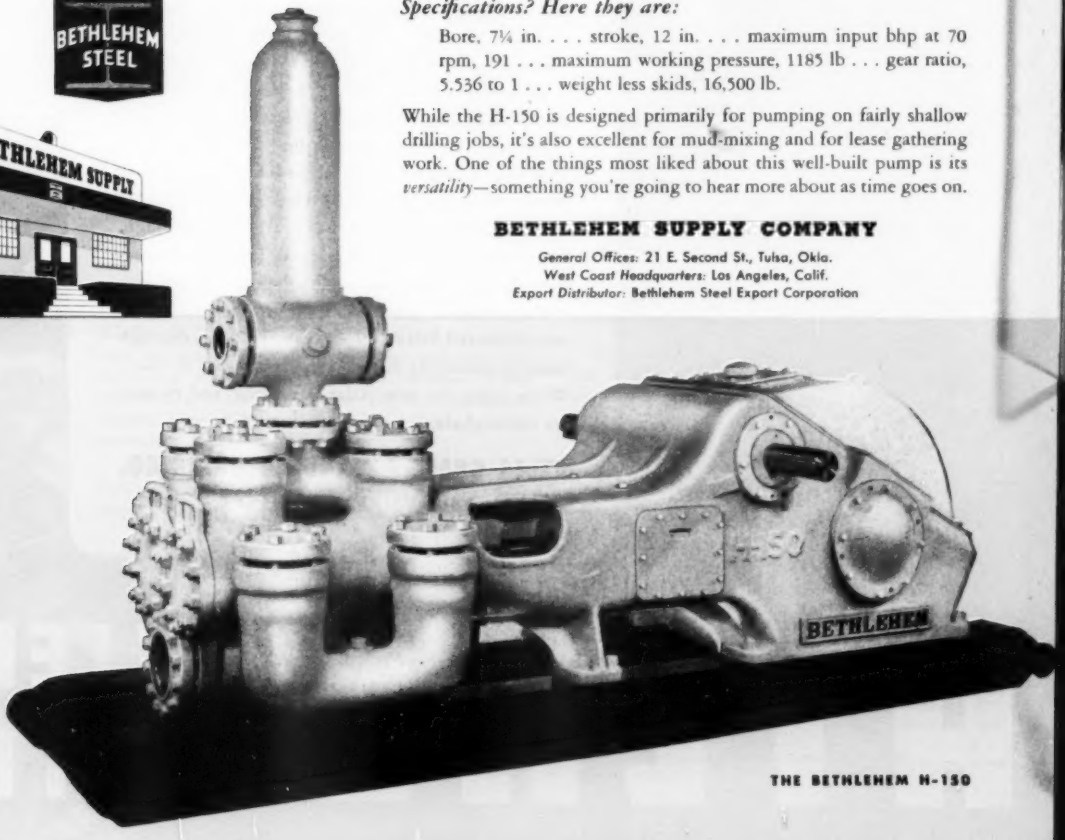
Specifications? Here they are:

Bore, 7¼ in. . . . stroke, 12 in. . . . maximum input bhp at 70 rpm, 191 . . . maximum working pressure, 1185 lb . . . gear ratio, 5.536 to 1 . . . weight less skids, 16,500 lb.

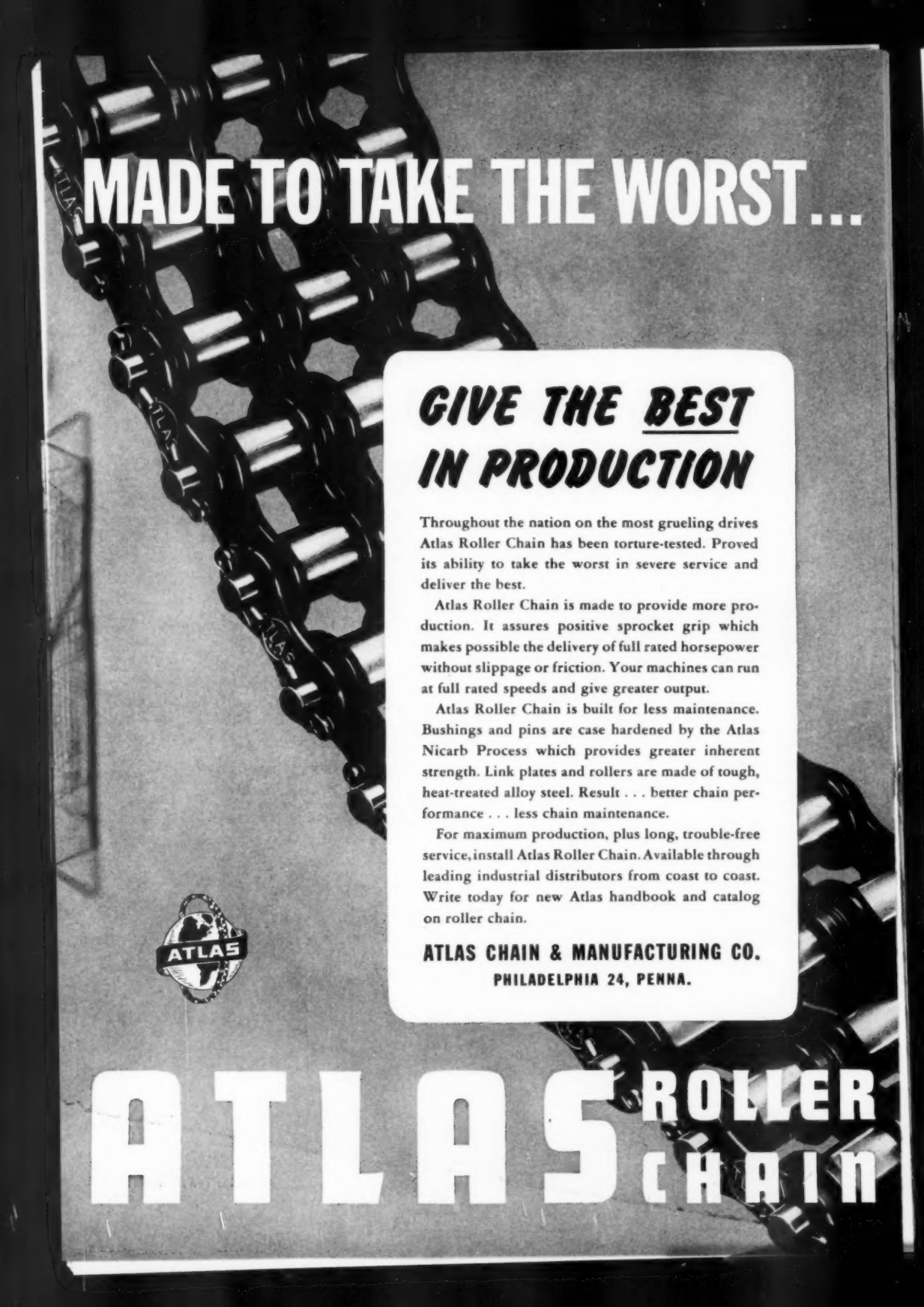
While the H-150 is designed primarily for pumping on fairly shallow drilling jobs, it's also excellent for mud-mixing and for lease gathering work. One of the things most liked about this well-built pump is its *versatility*—something you're going to hear more about as time goes on.

BETHLEHEM SUPPLY COMPANY

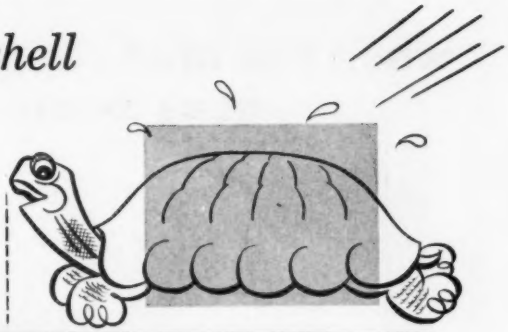
General Offices: 21 E. Second St., Tulsa, Okla.
West Coast Headquarters: Los Angeles, Calif.
Export Distributor: Bethlehem Steel Export Corporation

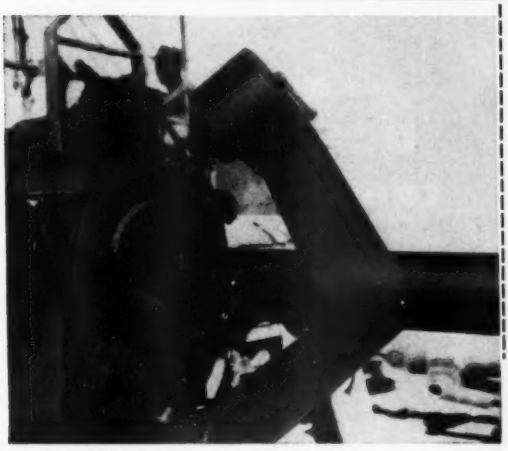


THE BETHLEHEM H-150


MADE TO TAKE THE WORST...
GIVE THE BEST IN PRODUCTION
Throughout the nation on the most grueling drives Atlas Roller Chain has been torture-tested. Proved its ability to take the worst in severe service and deliver the best.
Atlas Roller Chain is made to provide more production. It assures positive sprocket grip which makes possible the delivery of full rated horsepower without slippage or friction. Your machines can run at full rated speeds and give greater output.
Atlas Roller Chain is built for less maintenance. Bushings and pins are case hardened by the Atlas Nicarb Process which provides greater inherent strength. Link plates and rollers are made of tough, heat-treated alloy steel. Result . . . better chain performance . . . less chain maintenance.
For maximum production, plus long, trouble-free service, install Atlas Roller Chain. Available through leading industrial distributors from coast to coast. Write today for new Atlas handbook and catalog on roller chain.
ATLAS CHAIN & MANUFACTURING CO.
PHILADELPHIA 24, PENNA.
ATLAS
ATLAS ROLLER CHAIN

Like the turtle's tough shell that protects him so well...





Johns-Manville Asbestos Felt protects oil and gas pipe lines

Johns-Manville Asbestos Pipeline Felt now protects more than 100,000 miles of oil and gas pipe lines! *It is the only type of wrapper that has survived over 50 years of service in all types of soils.*

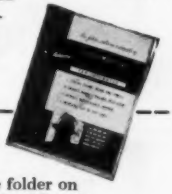
Johns-Manville Asbestos Felt is a sturdy product. It is resistant to rot and decay, and to acid and alkali soils. It has both the thickness and the toughness necessary for shielding pipe line enamels from damaging earth loads and soil stresses. These advantages make it possible for the protective enamel pipe coating to function properly against corrosion.

Johns-Manville Asbestos Felt is flexible. It wraps easily without cracking. It guards enamel from impact damage both during installation of field-wrapped pipe, and during transportation and installation of mill-wrapped pipe.

There are important economic benefits, too! Johns-Manville Asbestos Felt will help add many years to the life of the pipeline and help to keep maintenance costs low.

Johns-Manville Asbestos Pipeline Felt can be had in any width from 2" to 60", in any length desired.

For additional information and a sample of Johns-Manville Asbestos Pipeline Felt, simply fill in and mail the coupon provided below.



Johns-Manville
Asbestos
PIPELINE FELT

Johns-Manville
Box 290, New York 16, N. Y.
Please send me a copy of the sample folder on Johns-Manville Asbestos Pipeline Felt, PP-22A.

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Address_____

City_____ Zone____ State_____

when the mud goes down

..and DOESN'T come back

FIBERTEX A specially prepared fibrous material which, in careful tests, has proved superior to all other fibers tested. The matting or bridging effect of the fibers has walled off many types of porous or creviced formations which would have otherwise needed a cement job. Does not ferment or deteriorate in use, hence will not sour the mud. Reduces amount of preservatives needed in starch muds.

MICATEX Specially ground mica, effective by itself in mild cases of lost circulation. Often used with Fibertex in severe cases, where the combination has frequently been very successful. Does not swell or disintegrate in the mud, nor will the mica particles abrade pump liners, pistons and other parts of the mud system.

FINE MICATEX Where known mildly-porous formations exist, operators frequently add this specially sized flake mica to the mud before drilling into these zones of lost circulation. Since Fine Micatex has been ground fine enough to pass through the mud screens, it is not necessary to by-pass the shale shakers when using this product.

JELFLAKE Light, tough cellophane foil scraps, which bridge or plug many types of porous formation. Easy and clean to handle, and does not swell or disintegrate in the well fluids.

...it's time for these TESTED BAROID PRODUCTS

We won't waste your time by telling you how serious lost circulation can be—every operator knows that—or by trying to pretend that these products are sure-fire remedies for every job. You know better, since no two cases of lost circulation are ever exactly alike. But thousands of experienced operators who have used Fibertex, Micatex and Jelflake, either singly or in combination, can tell you that they do stop lost circulation in the great majority of cases—and do it better, faster and cheaper than anything else that can be used. And, if nothing else does the job, you have Aquagel cement which does the job in everything but actual caverns.

Your Baroid Service Engineer can tell you more!

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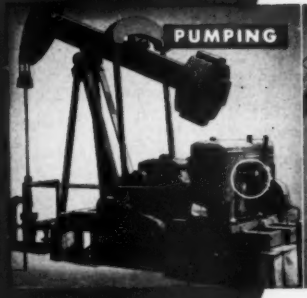
when time is money!

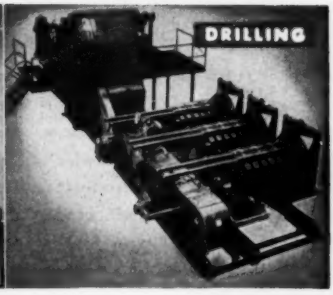
Drillers and production men look to

ENSIGN CARBURETION

for DEPENDABLE low cost

GAS ENGINE PERFORMANCE





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Oil-Field Standouts

ALL-ROUND usefulness combined with dependable operation — that's one big reason why Bucyrus-Erie rigs are oil field standouts. They're ready to tackle dozens of jobs — trenching, uncovering pipe line leaks, building access roads, leveling at location, digging slush pits, handling drill pipe, moving and erecting equipment. And where speed is vital and lost time costly, Bucyrus-Erie reliability puts you profits ahead.

The day-after-day, year-after-year service records of these outfits don't just happen. Here are some "reasons why" behind Bucyrus-Erie performance:

1. Parts are simple, large, few in number and enduringly aligned — there's little to go wrong.
2. All adjustments are easily made — and they last!
3. Machinery is accessible for quick, easy service, parts replacement and lubrication.
4. Digging cycle is balanced, coordinated, fast. No over-stressing of parts to cause too-frequent adjustment and repairs.
5. Controls are conveniently grouped in one place — no lost motion from hopping around.
6. Generous use of antifriction bearings makes performance smooth, quiet, easy on machine and operator.
7. Design is individual — each machine matched to its range of work.
8. Moves are fast, sure. Machine steers easily, makes sharp or gradual turns, climbs grades to 30%.

See your Bucyrus-Erie distributor for more details on this outstanding ⅜- to 4-yard line of gasoline, diesel and single-motor electric excavators.

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MOST PREFERRED

SOUTH MILWAUKEE BUCYRUS ERIE WISCONSIN

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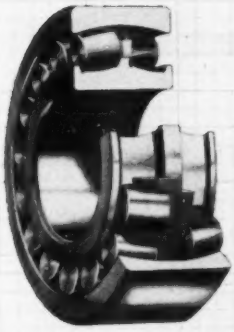
workhorse of the deep drilling rig

...mounted on Torrington Bearings



When the drilling gets deep, all 1600 horsepower of the Brewster N-12 Drawworks are kept busy—driving the drill-string, lowering casing into the hole and moving heavy equipment. Torrington Spherical Roller Bearings on the drum and line shafts of the N-12 help this workhorse stay on the job, hour after hour, with little time out for maintenance.

Spherical Roller Bearings automatically compensate for shaft deflections caused by shock loads . . . eliminate binding stresses that limit bearing life. The tremendous capacity of these heavy-duty bearings assures smooth operation under the roughest conditions.

Why not find out what the advantages of Torrington Spherical Roller Bearings can do for your heavy-duty equipment? Our engineers will be glad to assist you.

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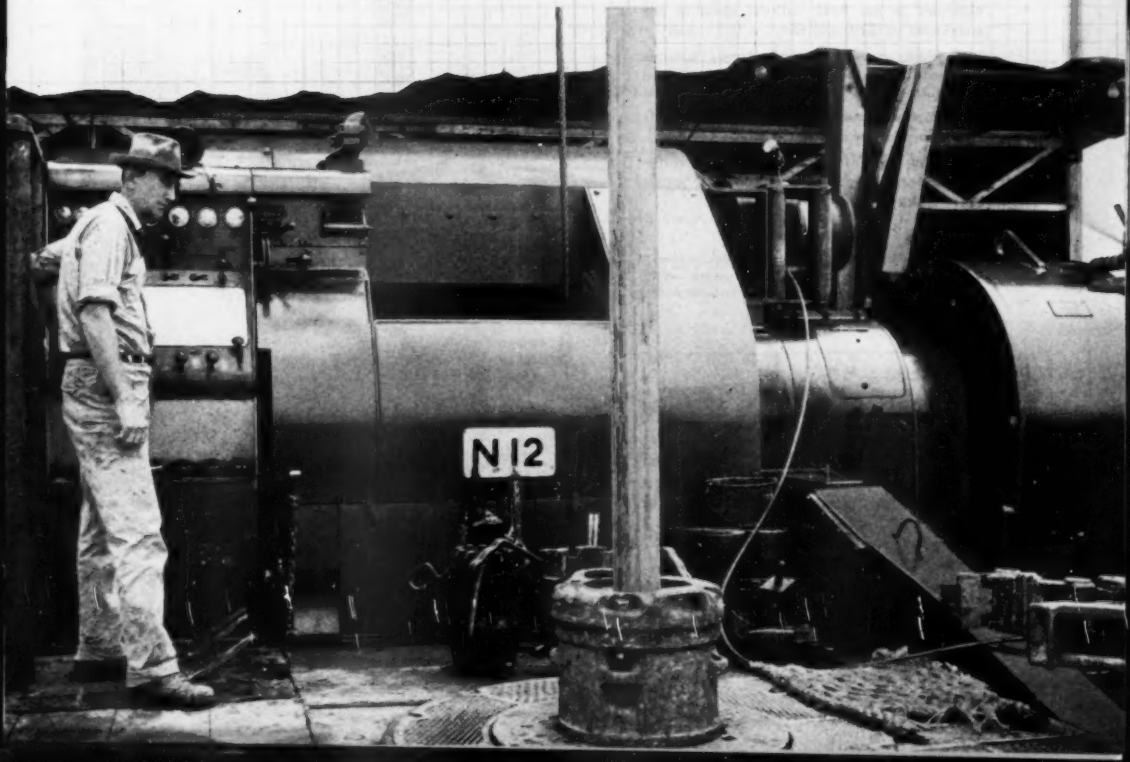
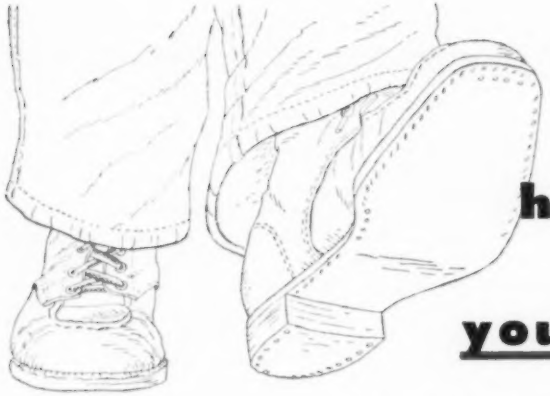
TORRINGTON *SPHERICAL ROLLER* **BEARINGS**

SPHERICAL ROLLER • TAPERED ROLLER • STRAIGHT ROLLER • NEEDLE • BALL • NEEDLE ROLLERS





his footwork solves <u>your</u> guesswork!

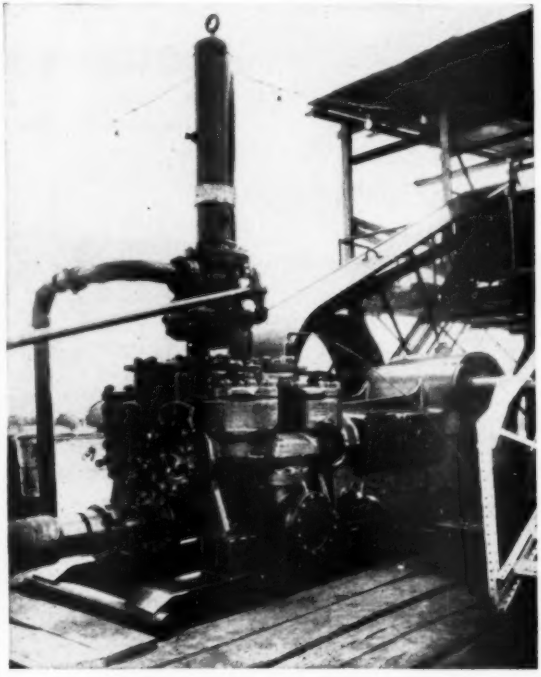
Footwork is second nature with a Gardner-Denver field engineer. He often tramps around the oil fields, learning first hand just what your most troublesome drilling problems are — just what you expect a slush pump to do.

That's one reason Gardner-Denver Slush Pumps meet your needs so well. You don't have to guess about their performance on your rig.

Check these field-proved FX features:

- **Divided liquid cylinders of GarDurloy—the extra tough alloy specially developed for mud pump service.**
- **"Slush-proof" liquid end parts—easily changed in the field without opening the crankcase to dust and dirt.**
- **Rigid, one-piece main frame assures accurate alignment—extra strength and safety.**
- **Positive, mud-stop protection prevents contamination of crankcase oil.**
- **Plus: eccentric construction—herring-bone gears—flood lubrication—and many other quality features.**

Ask your Gardner-Denver field engineer for expert advice on mud pump selection. Or write us for further information.



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You can deposit more weld metal in less time and avoid wasting electrodes by using the right electrode for the job, approved techniques, and by following the manufacturer's recommendations. G-E electrodes give you high deposition rates, meet AWS specifications, and are available in a wide variety of sizes and types.

Get more from your electrodes today by:

1. **Laying flat-face fillets on vertical fillet welds**
2. **Making fillet legs of equal length on horizontal fillets**
3. **Providing better "fit-ups"**
4. **Protecting welding rods through better storage and care**
5. **Avoiding bending whenever possible**
6. **Using electrodes down to a 2-inch stub**

Bending electrodes wastes about ¼ of their useful length (Fig. 1) as does the habit of throwing away "long" stub ends (Fig. 2).

Fig. 1. *Three* electrodes used straight may give as much production as *four* which are bent before being used.

Fig. 2. *Three* electrodes burned down to a 2-inch stub may do as much as *four* when "long" stub ends are left.

NEW! Welding Electrode Slide Comparator tells in an instant the AWS designation of manufacturer's electrodes.

See your G-E Welding Distributor for your comparator. Look for General Electric under "Welding Equipment" in the yellow pages of your telephone directory. And remember, he carries a complete line of G-E welders, electrodes and accessories.

GENERAL ELECTRIC

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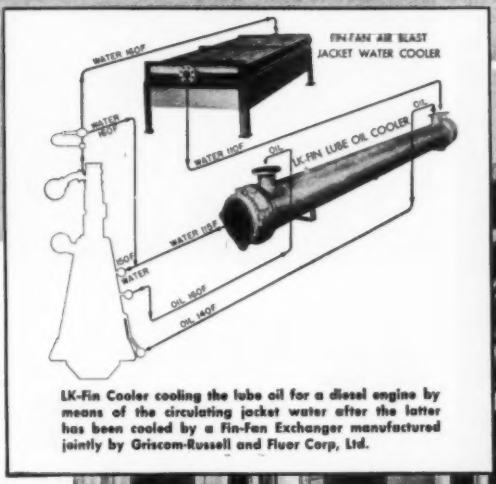
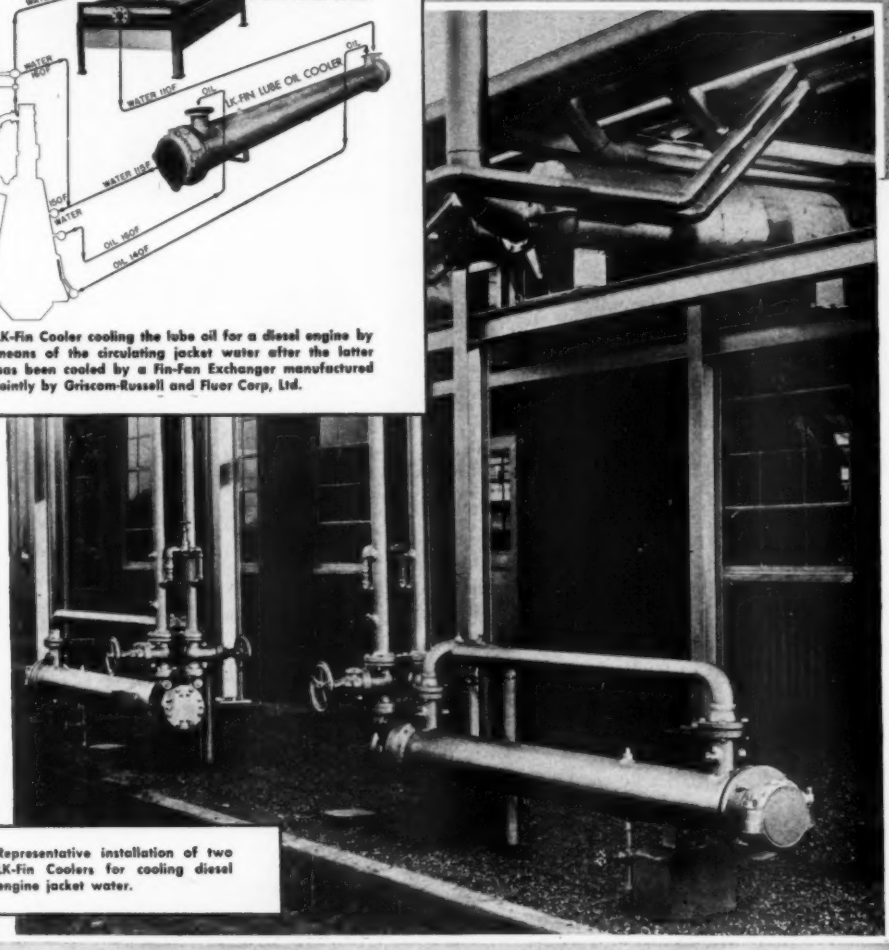
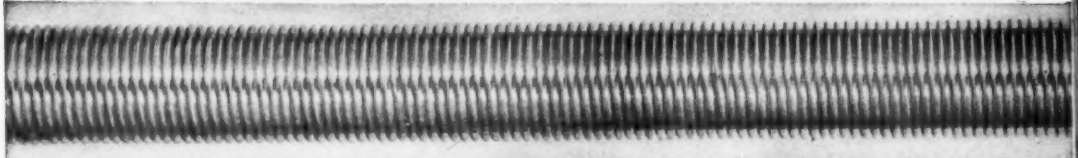
Why LK-FIN means a more



LK-Fin Cooler cooling the lube oil for a diesel engine by means of the circulating jacket water after the latter has been cooled by a Fin-Fan Exchanger manufactured jointly by Griscom-Russell and Fluor Corp, Ltd.



Representative installation of two LK-Fin Coolers for cooling diesel engine jacket water.



GRISCOM-RUSSELL: PIONEERS IN HEAT TRANSFER APPARATUS

effective, compact, economical

LUBE OIL OR JACKET WATER COOLER

It's because of the *fins* on the cooling elements. These fins greatly increase the external heat transfer surface . . . enable a considerably shorter tube to perform the same cooling effect that requires a much longer bare tube.

The results . . . a more compact cooler because of the more effective heat transfer surface . . . a more economical unit because of the shorter tubes and shell.

What diameter . . . thickness . . . pitch . . . should the fins be to accomplish these results? That's where G-R's unmatched know-how comes in . . . a knowledge gained from 20 years of experience in building *finned-type* heat exchangers and the results obtained from many tens of thousands of installed finned-tube units.

And the exclusive use of LK-Fin tubes is only one of the many distinctive features of these coolers. Write for bulletin describing them in detail, with rating tables and selection data.

THE GRISCOM-RUSSELL CO., MASSILLON, OHIO

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GRISCOM-RUSSELL: PIONEERS IN HEAT TRANSFER APPARATUS

-pipe with the yeoman's!

We praise the job being done by distributors of Wheatland Tube Company products—day in and day out. Their job of servicing your industry with the material you need when you need it, taking into consideration the thousands of items which are so important, grows more difficult daily.

Pride in quality—pride in service—our Congratulations to jobbers everywhere!

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"for performance and durability I'll put my confidence in CP Three Cone Bits"
Lester Sarratt of Crown Drilling Company
Type ES Series for soft formations
Type EM Series for medium hard formations
Type EH Series for hard formations

— says Lester Sarratt, tool pusher for Crown Drilling Company, of Oklahoma City, drillers of sixty wells in the Golden Trend area of Garvin County, Oklahoma.

"For four years I have run CP bits at all depths and in all formations against every other type of bit, and their performance has reflected the fine engineering, skill and care that go into their construction."

CP Three Cone Rock Bits are available in all popular sizes in types for soft, medium hard and hard formations. Prompt service is assured in the Mid-Continent, Rocky Mountain, Canadian and Mexican fields.

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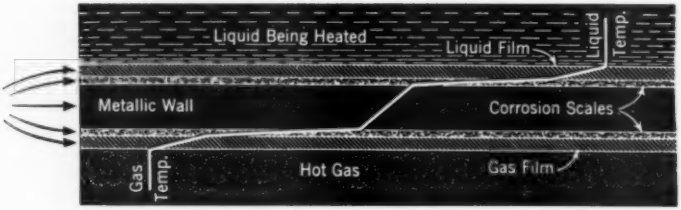
Can you figure all the walls in heat exchange?

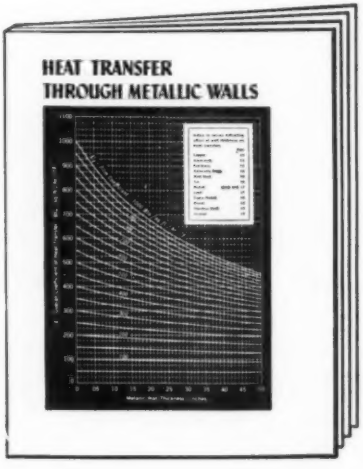


Add *two* unknowns to the heat transfer rate of a metal – and what do you get?

You get the problem that faces a designer trying to calculate the true performance of a proposed heat exchanger.

The rate of heat movement through a metal itself—of any thickness—is easily determined. But the effect of the gas or liquid films that will adjoin the metal wall is difficult to predict. And even more uncertain and more damaging, is the scale or oxide layer that forms on the metal surfaces.

The nature of the scale layer – its thickness, density, and chemical composition, is governed by conditions that vary in each case. But the insulating, or interfering, nature of the scale layer is tremendous.



Engineers are fast learning to hold scaling difficulties to a minimum—through the selection of metal. Nickel and high-Nickel alloys are among the preferred metals because of their resistance to scale formation.

Nickel forms a very thin, tough, oxide layer for self-protection. This layer is so thin it is often invisible. *But,* this thin layer prevents a buildup of more oxide, protects the metal against corrosive attack that would form other coatings.

The mechanical properties of Nickel alloys give high resistance to erosion or pitting from gas, steam, or liquid. Its strength and toughness also permit *thinner* walls, resulting in *faster* heat transfer.

INCO has issued a booklet—HEAT TRANSFER THROUGH METALLIC WALLS—that contains invaluable information on heat exchange performance of many metals. A copy of this bulletin will be sent free on request.

And if you have a specific heat transfer problem—the solution may be one of the INCO Nickel alloys. Right now, of course, much of Inco's production is being diverted to defense. But INCO's Corrosion Engineers are eager to aid in overcoming corrosion obstacles, both for defense operations now, and for future projects. Write us about your problem, giving full information.

The International Nickel Company, Inc.
67 Wall Street, New York 5, N. Y.

Don't let "tough" locations restrict your field operations!

Haul with WALTER TRACTOR TRUCKS

Oil is where you find it . . . most always in "tough" locations. Put the tremendous power-plus-traction of Walter Tractor Trucks to work hauling your rigs and equipment through mud, sand, soft dirt, slippery surfaces, up steep grades.

Walter Tractor Trucks are specially designed for rugged, heavy-duty, off-the-road hauling. The exclusive Walter 4-Point Positive Drive converts every horsepower into 100% tractive power. All four wheels have positive drive. Automatic locking and torque proportioning differentials concentrate most power on the wheels having most traction at any moment. Never any wheel-spinning as in conventional drives, which become helpless on soft or slippery surfaces.

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• With its 100% four wheel traction and high power, this Walter tractor trailer-hauls 20 to 25 ton payloads of rigs, pipe or heavy equipment to toughest field locations. Will haul gross train weights of 70,000-80,000 lbs. within legal highway axle loading and width limitations. Ruggedly built—easy handling and maneuvering.

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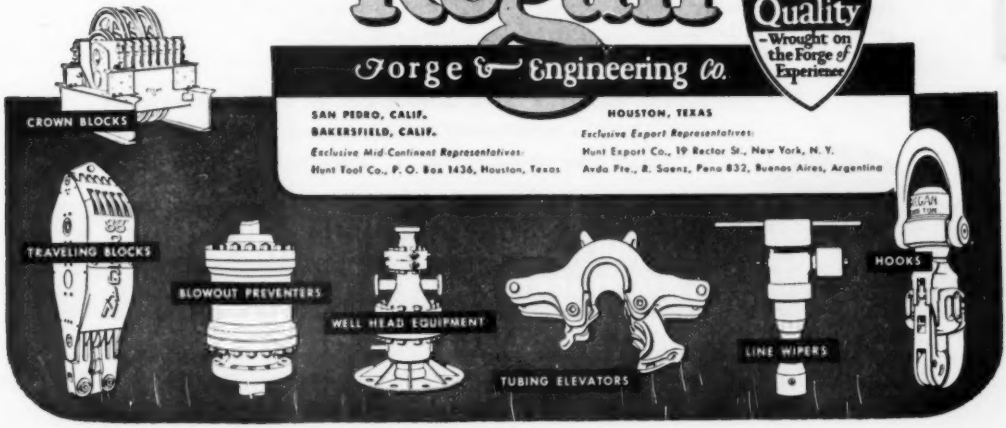

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WHEN YOU RENT a Sperry-Sun instrument, whether it is a Syfo Clinograph, E-C Inclinometer, Single Shot or Non-Magnetic Drill Collar — or call for a Surwel Multishot Survey — or submit a core for orientation—you get service. We make frequent calls to check each rental instrument to assure you that it is in working order. Business worth getting is worth keeping.

Accuracy and dependability are assured by the exclusive design and precision manufacture of these instruments. If you're not acquainted with these points of superiority, ask the Sperry-Sun representative about them the next time he's around.

For Accuracy and Service *with* Speed, call us.

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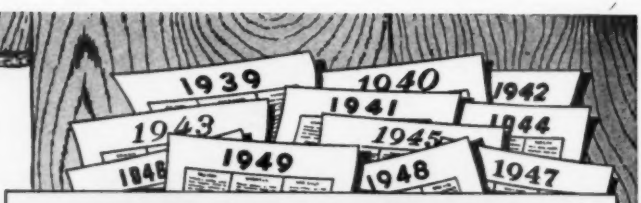
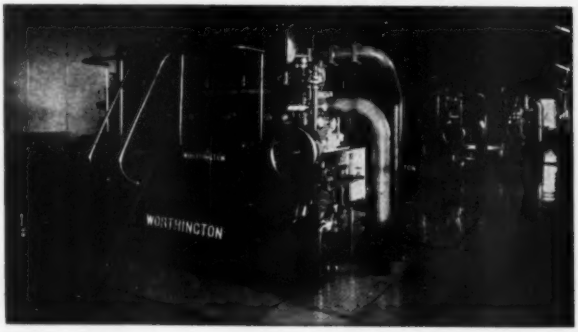
Ten years of trouble-free operation ...on crude oil fuel!





Three of the Utah Oil Refining Company's Five Worthington Diesel Engines on pipeline duty at Wamsutter, Wyoming.

Worthington Diesels Require Only Routine Monthly Inspection For Continuous Top Performance

How well can a Diesel engine perform on crude oil fuel? For an action-proved answer, consider the Worthington Diesels at the Wamsutter, Wyoming, pumping station of the Utah Oil Refining Co. Located near the crest of the Continental Divide, the plant pumps crude oil (daily maximum: over 40,000 bbls) from sources in Colorado to points east and west.

Five Worthington Diesels, ranging from 250 to 820 hp, are used. Two were installed late in 1939; the others in 1946, 1947 and 1949. *All burn crude oil of 32° gravity.*

High altitude and harsh winters make operating conditions severe, yet the two oldest Worthingtons — until after ten years and nearly 50,000 hours each of steady duty — *had never had their pistons pulled or valves ground.* And the other three give every indication of equalling this long, trouble-free record!

MORE EXAMPLES

Wherever oil is moved through pipelines, Worthington Diesels are serving. Latest Worthington supercharged and atmospheric Diesels are successfully burning crude oil from lines stretching across Texas. Almost half a century of experience with every type of crude oil fuel has provided a sound background for assured customer satisfaction with modern Worthington Diesels.

Crude oils, Diesel oil, some residue oils, natural gas, producer gas — all are successfully fueling modern Worthington Diesels and spark ignition engines — in almost every type of power service. For further facts proving *there's more worth in Worthington*, write to *Worthington Pump and Machinery Corporation, Engine Division, Buffalo, New York.*

WORTHINGTON

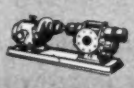
E.O.4

YOUR PARTNER IN POWER PROGRESS

WORTHINGTON-BUILT AUXILIARIES

Diesel engines, 150 to 3,520 hp . . . gas engines, 175 to 3,520 hp... dual fuel engines, 225 to 3,290 hp.

Balanced Angle Compressors


Oil Transfer Pumps

Cooling Water Circulating Pumps

Evaporative Type Engine Water Cooler

This month we'll ship our 30,108th mile of large diameter welded line pipe

This month we will have shipped 30,108 miles (4,500,000 tons) of A. O. Smith Line Pipe for the world's growing pipe line networks.

In the latter part of 1927, when A. O. Smith introduced its large diameter, high strength, welded line pipe, the entire industry could turn out no more than three miles of large diameter pipe per day. *By 1928,* A. O. Smith had increased its capacity to more than 15 miles per day.

Virtually overnight A. O. Smith opened the way for the construction of many contemplated lines which were not economically possible until an adequate and assured supply of pipe was available.

Since that time, by every means known to science, the SMITHWAY process of pipe manufacturing has been ceaselessly developed and perfected, offering ever greater assurance of accuracy, uniformity and reliability.

Today A. O. Smith is still the leader in the development and manufacture of large diameter line pipe and practically every major pipe line is wholly or partly built of our pipe.

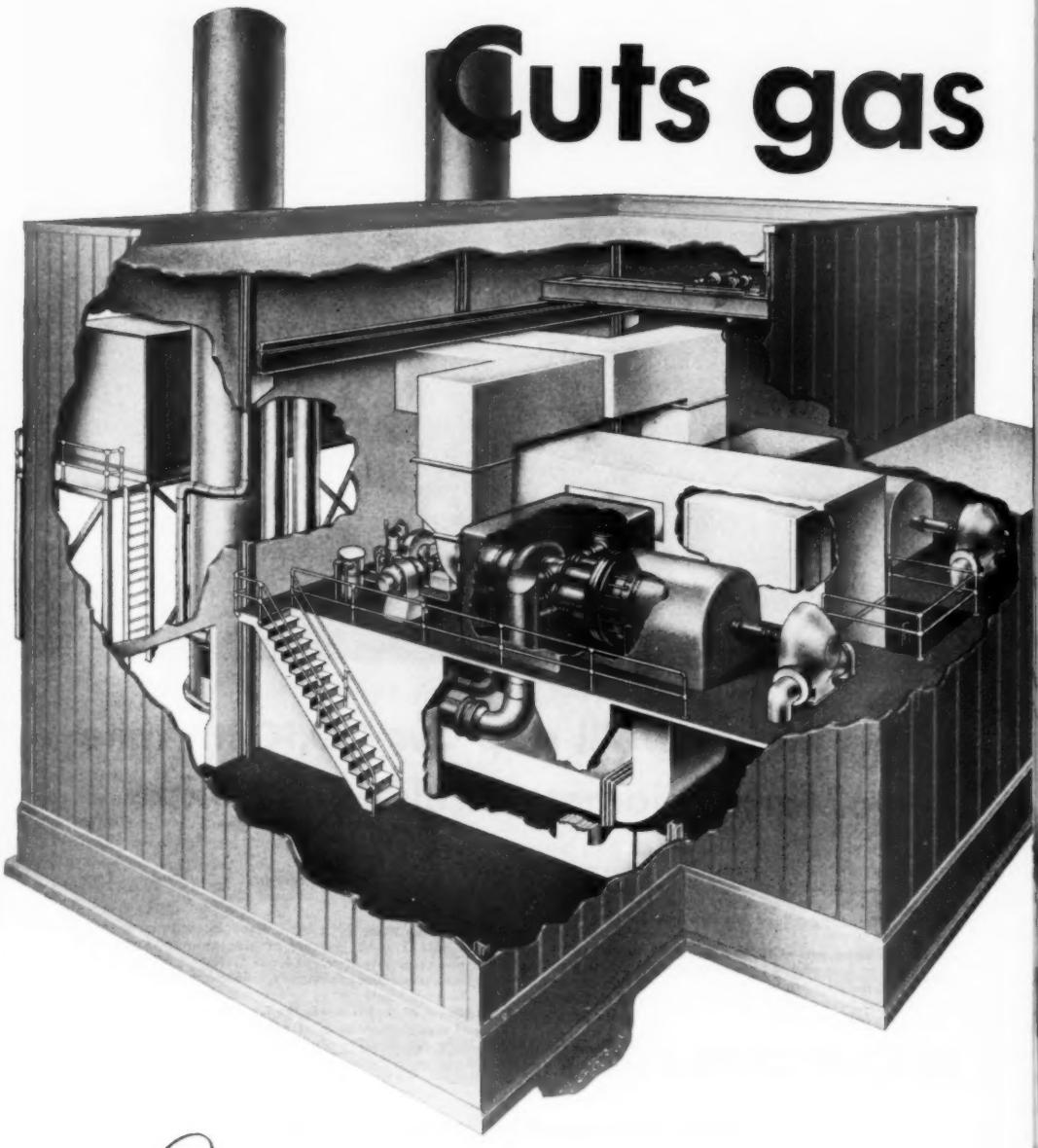
DEPENDABILITY through RESEARCH and ENGINEERING

A.O.Smith

CASING • LINE PIPE

Chicago 4 • Dallas 2 • Denver 2 • Houston 2 • Los Angeles 22
Midland 5, Texas • New Orleans • New York 17
Pittsburgh 19 • San Francisco 4 • Seattle 1
International Division: **P.O. Box 2023, Milwaukee 1**

Cuts gas



You can put your confidence in—

GENERAL ELECTRIC

661-29

pumping costs!

Now—substantial double savings can be yours with the G-E combustion gas turbine for gas pipeline pumping—a complete, practical, and reliable prime mover!

No doubt about it! The General Electric gas turbine—specially designed for gas pipeline pumping—offers gas pipeline operators really big savings in total annual costs. Here's how:

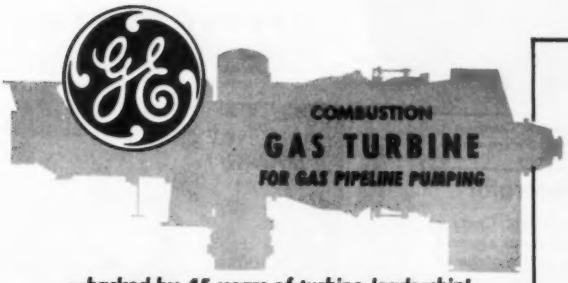
Cuts Construction Costs

In relation to available horsepower, the building housing the G-E gas turbine is small, simple, and inexpensively constructed. In the typical station layout at the left—containing two 5000-hp gas turbines each driving a centrifugal compressor—the building area is only 48 by 64 feet, with a roof elevation of 40 feet. Moreover, building and equipment foundations are less expensive because the turbines, and the centrifugal compressors they drive, are relatively small and light in weight.

Cuts Operating and Maintenance Costs

Essentially automatic in operation, the G-E gas turbine makes it possible to release manpower for other duties. The unit readily lends itself to remote operation of an unattended station. Maintenance is largely a matter of periodic inspection, since there are comparatively few moving parts subject to wear. Little or no make-up water is needed—an additional saving.

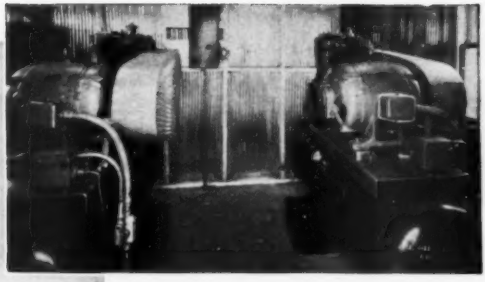
Other advantages? It delivers up to 25 per cent extra horsepower at no extra cost in winter—provides adjustable speed for operating flexibility—is inherently suited for use with readily available, high-efficiency centrifugal compressors.



—backed by 45 years of turbine leadership!

GET MORE INFORMATION!

Call your nearest G-E sales office, or send today to Section 661-29 for new 16-page booklet GEA-5530 that describes in detail how the G-E gas turbine can cut *your* annual pumping costs. *General Electric Company, Schenectady 5, N. Y.*



Above—Two 10 horsepower Century squirrel cage motors driving air compressors.

At left—7½ horsepower Century splash proof motor driving a pumping unit.

Century MOTORS for the Oil Industry
Assure Dependable, Economical Operation

Subjected to rain, snow, sleet and hail thousands of Century Splash Proof Type SCT High Torque High Slip Motors are operating producers' pumps—many for 18 years.

The high slip of the Century type SCT motor saves wear and tear on equipment because it slows down and cushions the impact of the peak load and reduces the sudden shock and its damaging effect.

Century builds a wide range of electric motors, in sizes from 1/6 to 400 horsepower, for oil producing and refining operations. Popular types and standard ratings are generally available from factory and branch office stocks.

Specify Century motors for all your electric power requirements. See your regular supply store.

Illustrating Century splash proof and explosion proof motors.

CENTURY ELECTRIC CO.
1806 Pine Street • Saint Louis 3, Missouri
Offices and Stock Points in Principal Cities

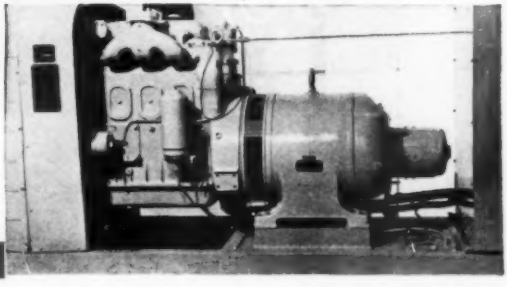
-620

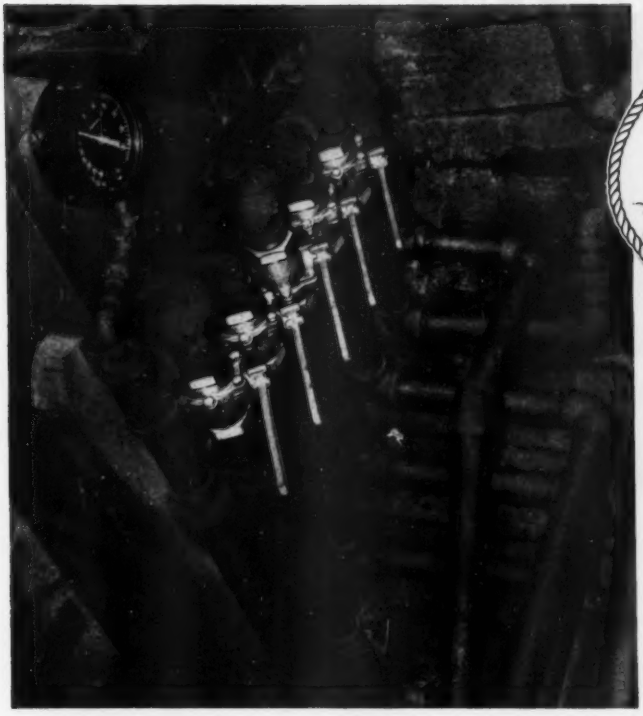
Century C MOTORS

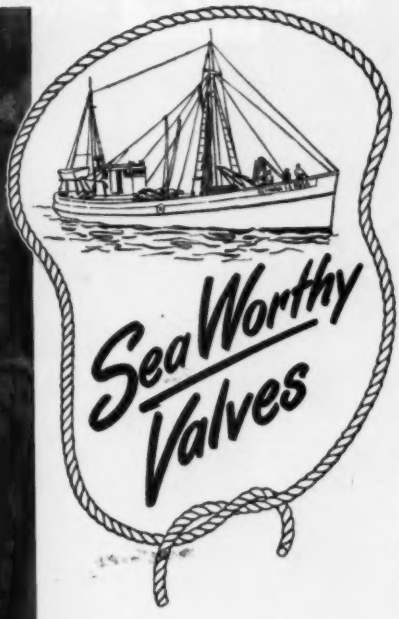
Century Electric Company is celebrating its 50th year in the electrical industry.

Century Type ARC Generator

Where public service current is not available, Century Generators will provide adequate, continuous electric power. Depending on the load per motor and the size of generator, from 10 to 30 wells can be operated from one generator. They provide a dependable source of oil field power.







Discharge Manifold used for quick change-over of discharge-water from two centrifugal pumps.

ROCKWOOD BALL VALVES perform perfectly against the hazards of salt water, fish scales, wood splinters, dirt, etc.

Every Rockwood Ball Valve used aboard these fishing boats has given *outstanding* service. They perform continuously without maintenance. Dirt and debris from bilges is no problem. Abrasive or corrosive mixtures pass thru valve without injury to rubber seat or ball. Quick change-over from pumping out boat to supplying wash water for deck is made easier and faster because of quick opening and closing action of valve.

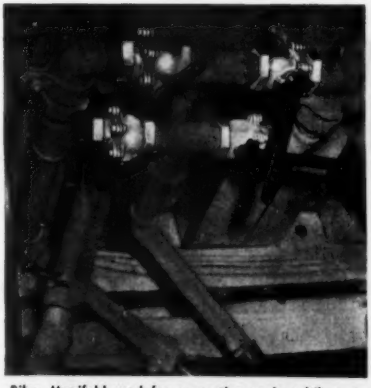
Mr. C. Perkins, Engineer of Hub Machine Company, Boston, Mass., says "Rockwood Ball Valves *out-wear* and *out-perform* all other makes of valves used previously on these installations."

Thousands of Rockwood Ball Valves are at work thru-out the country speeding production, cutting maintenance cost, helping maintain high quality and making piping operations easier.

Rockwood Valves are available in bronze in pipe sizes from ½" to 2" and in cast steel from 3" to 4". They are recommended for 300 p. s. i. working pressure. Rockwood Valves are in service in oil refineries, food, paper, textiles, chemical and rubber plants.

Write for bulletin V4 — and for information regarding applications, prices, etc.

Distributors in all principal cities.

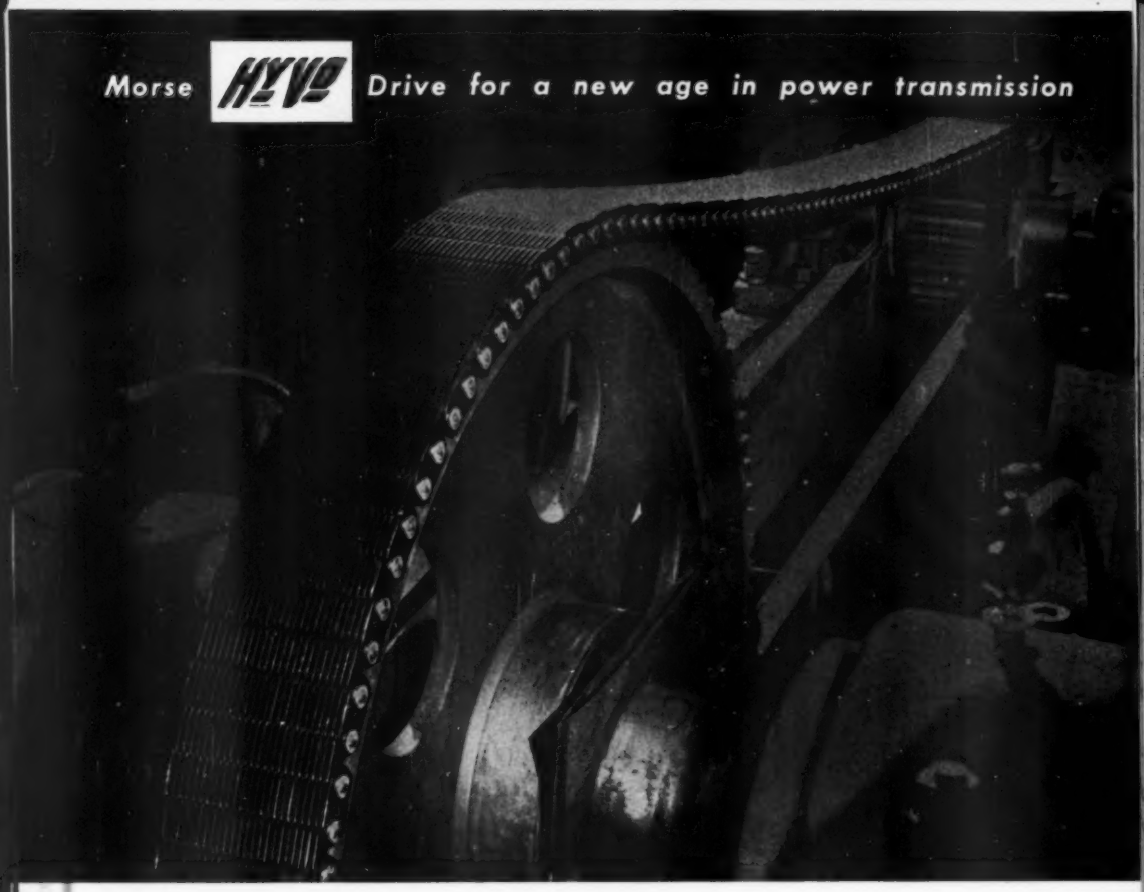


Bilge Manifold used for connecting various bilges to the pumps. Quick action is necessary because of limited time — also makes priming of centrifugal pumps easier.

ROCKWOOD

ROCKWOOD
SPRINKLER COMPANY
104 HARLOW STREET
WORCESTER 5, MASS.

Morse HY-VO Drive for a new age in power transmission



Morse Hy-Vo does 50% more work with 50% less chain

A *200-kilowatt* generator on the Standard Dredging Company dredge boat "Diesel" requires a 12"-wide silent chain drive.

When an additional generator was needed, the boat owners turned to Morse Hy-Vo (above). Result? The new *300-kilowatt* generator is driven by a 6"-wide Hy-Vo Drive. That's 50% more work with 50% less chain—and another application that Hy-Vo takes right in stride.

The Morse Hy-Vo Drive gives up to one-third longer service life, cuts operating costs per hour up to 50%. Morse Hy-Vo transmits more horsepower at greater speed (up to 5000 HP at 1200 RPM) and lower cost than any other standard drive.

New age in power transmission

Hy-Vo permits the transmission of vastly increased horsepower from smaller, less expensive, high-speed engines and motors—without costly accessories. Hy-Vo is the latest addition to a complete line of products that has made the name Morse a byword for the best in power transmission equipment and engineering.

Write today for Hy-Vo Catalog C 72-51—or for information on Morse Silent Chain or Roller Chain Drives, Morse Flexible Couplings, Morse Drive Shafts, or Morse Clutches. (Hy-Vo orders must carry priority rating at present time.)

Branch offices serving the petroleum industry: 1312 LaBranch Avenue, P.O. Box 896, Houston, Texas; 1571 Harding Avenue, Pasadena, California; 503 Martin Bldg., Pittsburgh, Pennsylvania.

More than ever, M=PT—Morse means Power Transmission.

MORSE
MECHANICAL
POWER TRANSMISSION
PRODUCTS

BW

MORSE CHAIN COMPANY • Dept. 214 • 7601 Central Ave. • Detroit 8, Mich.

WELDOLETS

WELDING FITTINGS FOR ANY PIPING SERVICE

NATURAL GAS COMPRESSOR STATION PIPING CONSTRUCTED ECONOMICALLY AND EFFICIENTLY USING WELDOLET WELDING FITTINGS THROUGHOUT

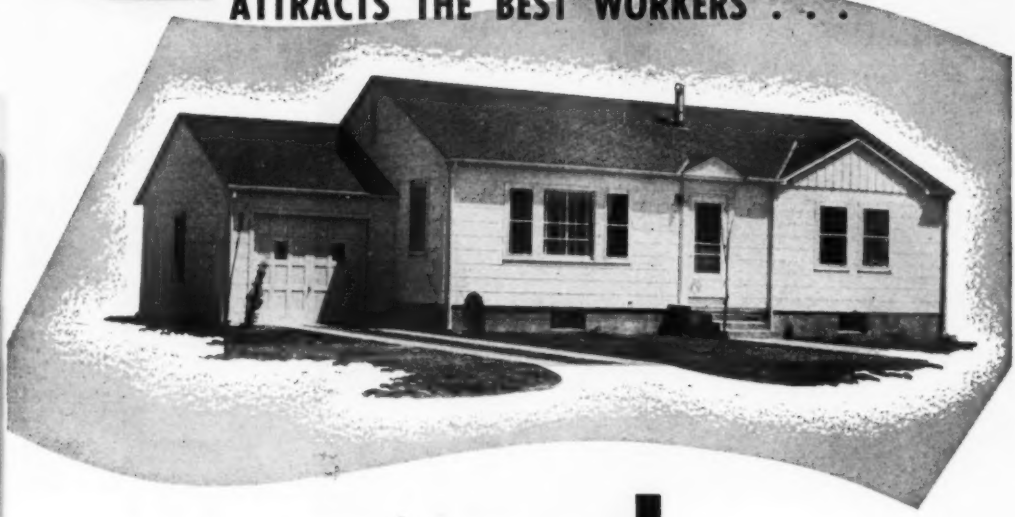
This installation illustrates a number of typical applications of WeldOlet Welding Fittings in various types of piping. A copy is in the new Bonney-Vulk WeldOlet Catalog.

This completely new Bonney catalog will furnish descriptive, dimensional information and installation instructions. The layout of various diagrams demonstrates graphically how WeldOlet Welding Fittings offer the quickest, easiest and most economical method of establishing any predetermined [illegible] strength at branch connections in accordance with code [illegible].

For [illegible] write to BONNEY FORGE & TOOL WORKS, 66 Gum St., Allentown, Pa.

Good housing

ATTRACTS THE BEST WORKERS . . .



STURDYBILT Prefabricated Houses are as attractive, and as snug and comfortable as homes of comparable size in any community. STURDYBILT Houses are the type of homes city families are used to. That's why oil field workers are happier working for a company that uses STURDYBILT homes exclusively.

Your workers are your most important asset. See that they are well housed while in the field. Specify STURDYBILT Prefabricated Homes for your next field housing project.

MANUFACTURERS OF SPECIAL MILLWORK, DISTRIBUTORS OF JOHNS-MANVILLE BUILDING MATERIALS; CURTIS WOODWORK

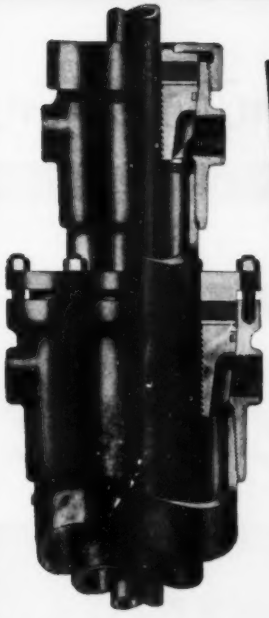
STURDYBILT PREFABRICATED, DEMOUNTABLE HOUSES

SOUTHERN MILL & MANUFACTURING CO. • TULSA, OKLAHOMA

STURDYBILT HOUSES COMPLY WITH COMMERCIAL STANDARD CS125 OF THE NATIONAL BUREAU OF STANDARDS FOR PREFABRICATED HOMES

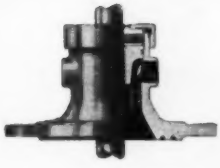
RECTOR REDHEAD

gives you widest variety of low-pressure casing and tubing head arrangements.

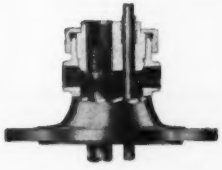


Type R Forged Steel Casing and Tubing Heads

● Threaded bottom Type R Tubing Head with slips and stripper. For workover jobs a second stripper can be used in place of the slips in the adapter bowl. Slips and stripper are interchangeable in head and bowl.



● The Type R Tubing Head with light flange for use on low pressure well having a flanged casing head . . . or to replace high pressure tubing head and tree when changing from flowing to pumping conditions.



● The original tubing head installation can be adapted to the Kobe Pump simply by using the special threaded mandrel with stuffing box for the power lines. The mandrel, resting on a ground joint seat, has an "O" ring seal.

● Type "R" Casing Head with threaded bottom. Notice how ribbed construction of slips permits full flow to side outlets, also simplicity and effectiveness of sealing arrangement.

RECTOR WELL EQUIPMENT COMPANY INC

★ MAKING THE OIL INDUSTRY SAFER ★

1100 NORTH COMMERCE ST. FORT WORTH, TEXAS

Houston Plant: 2215 Commerce St.

REPRESENTATIVES IN ALL ACTIVE FIELDS

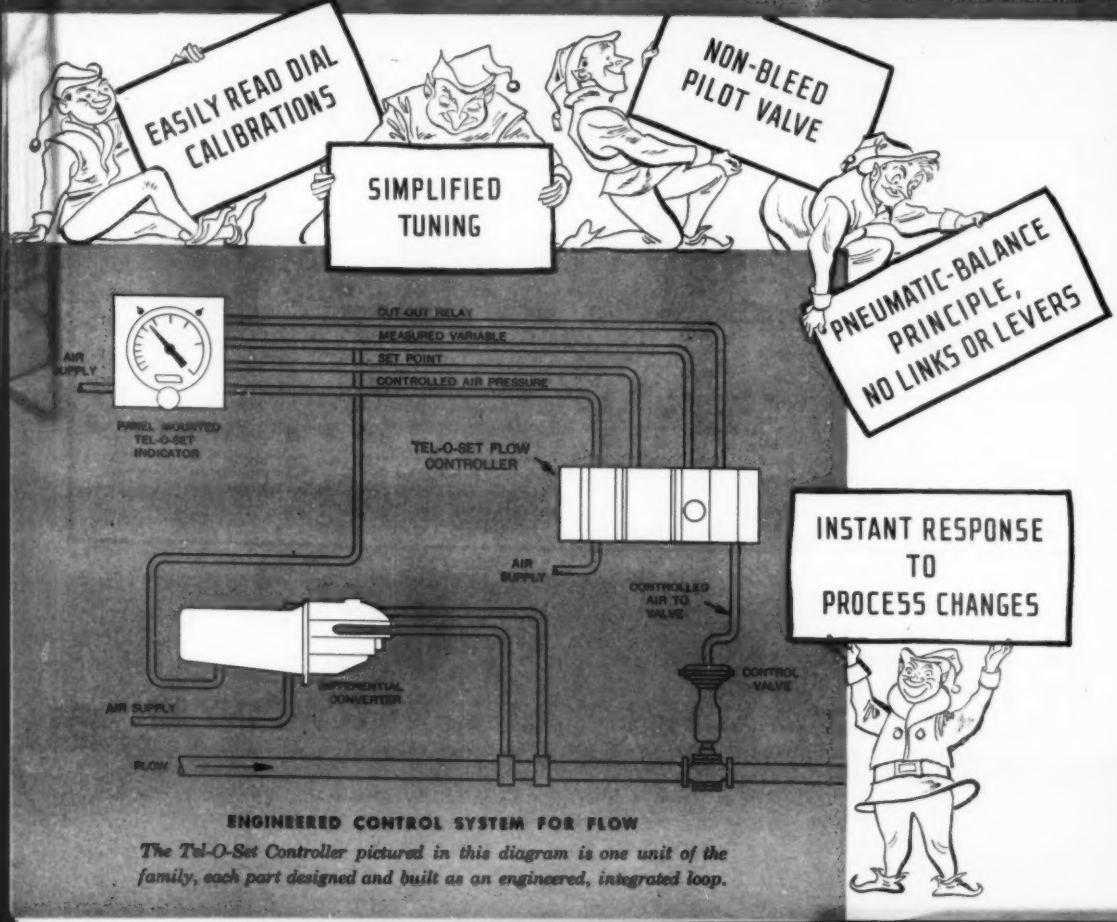
RECTORHEAD RECTOR FULBORE CEMENTING METHOD RECTORSEAL

ASSOCIATION OF WELL HEAD EQUIPMENT MANUFACTURERS CERTIFIED

Important Contribution

Introducing..

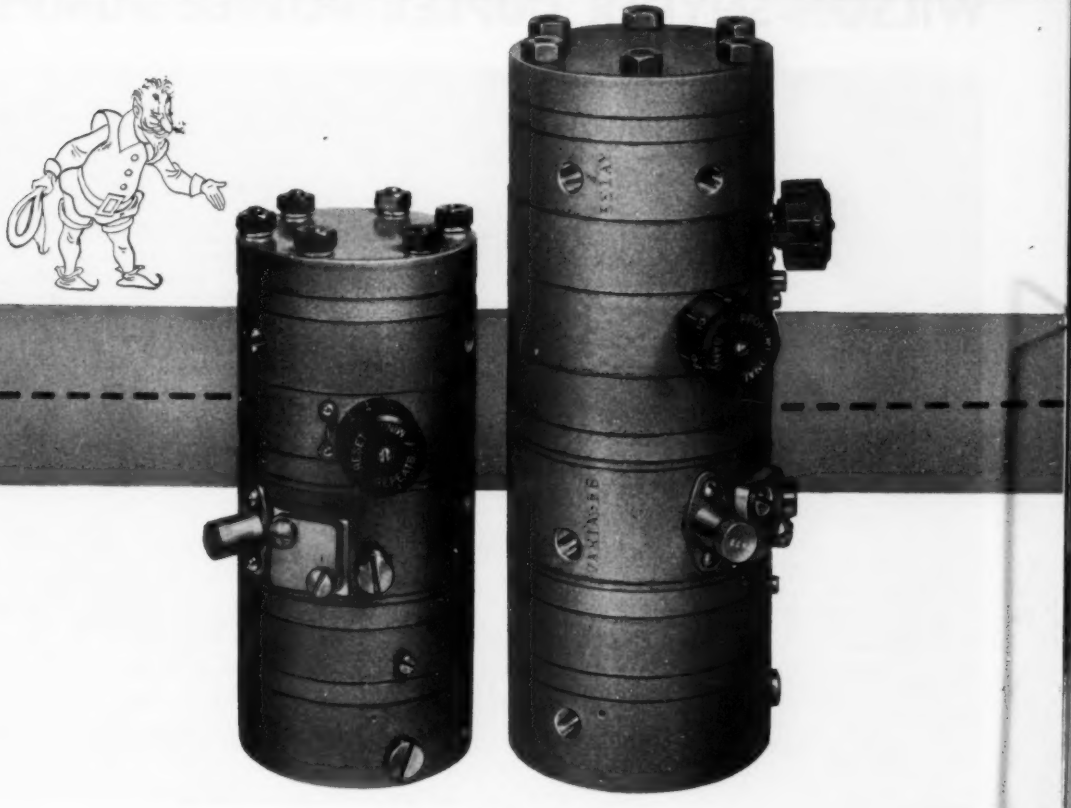
The New TEL-O-SET CONTROLLERS



ENGINEERED CONTROL SYSTEM FOR FLOW

The Tel-O-Set Controller pictured in this diagram is one unit of the family, each part designed and built as an engineered, integrated loop.

to Process Control



- **FOR ALL CONTROL APPLICATIONS —**
  Flow, temperature, pressure level and other process variables.
- **FOR GREATEST ECONOMY IN APPLICATION —**
  Three control forms available.
- **FOR OPTIMUM FLEXIBILITY —**
  Universal bracket for control room, valve yoke or structure mounting.
- **FOR EASY MAINTENANCE —**
  Coded, interchangeable sections. Split manifold permits removal of controller while on manual by-pass.

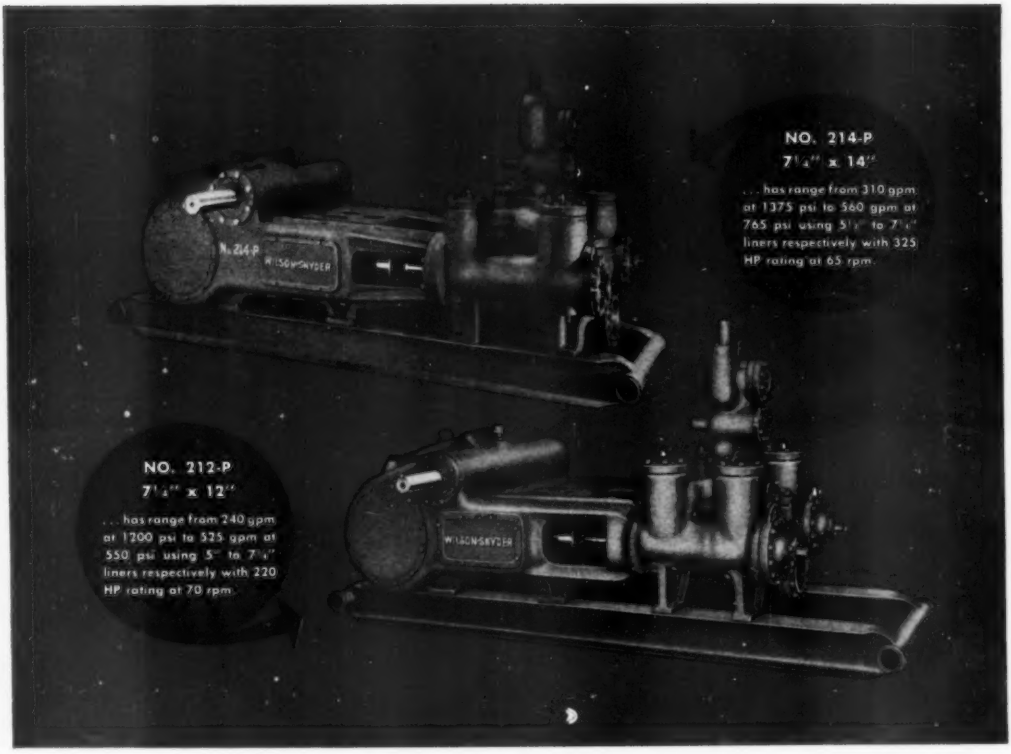
For detailed information, write for a copy of Specification Sheet No. 768 . . . and call in our local engineering representative for a discussion of your process needs.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4488 Wayne Ave., Philadelphia 44, Pa.

MINNEAPOLIS
Honeywell
Brown Instruments

H HONEYWELL

For Medium-Depth Drilling You Can't Beat These Two
WILSON-SNYDER DUPLEX POWER PUMPS


NO. 214-P
7¼" x 14"
. . . has range from 310 gpm at 1375 psi to 560 gpm at 765 psi using 5½" to 7¼" liners respectively with 325 HP rating at 65 rpm.
NO. 212-P
7¼" x 12"
. . . has range from 240 gpm at 1200 psi to 525 gpm at 550 psi using 5" to 7¼" liners respectively with 220 HP rating at 70 rpm.

Two important sizes in the Wilson-Snyder line of Power Pumps are the 214-P and the 212-P, built especially for medium-depth drilling. Here are a few of their many features:

One piece, high strength power frame.
One-piece, direct-flow type, cast steel fluid end with large passages for easy flow.
Heavy-duty, field-adjustable roller bearings throughout.
DI-HARD, long-life, fluid-cylinder liners and DI-HARD piston rods.
Forged alloy-steel, heat-treated, fluid valves and seats.
Power end lubricated with combination oilbath and positive-flow lubrication.
Crosshead-pin roller bearings, diaphragm stuffing boxes, and fluid-end stuffing boxes are pressure grease-lubricated.

Call or write Houston headquarters or your nearest Wilson Supply store for additional information

EXCLUSIVE DISTRIBUTORS — LOUISIANA AND TEXAS GULF COAST

WILSON SUPPLY COMPANY

BRANCH STORES

Texas — Alice, Corpus Christi, Victoria, Bay City, Columbus, Barbers Hill, Liberty, Beaumont, Kilgore, Monahans. **Louisiana** — Lake Charles, New Iberia, Houma, Harvey, Shreveport.

1412 Maury St.
HOUSTON, TEXAS

Sales Offices:
DALLAS, TEXAS
TULSA, OKLAHOMA
NEW ORLEANS, LA.

SPICER DESIGN

assures integration into the vehicle

SPICER ability makes itself most apparent in the ultimate performance of vehicles using Spicer units.

SPICER integrated design helps efficiently to transform *power into payloads,* through harmonious cooperation with all other motive units in the entire assembly.

SPICER builds nearly a half-century of designing and manufacturing experience into its products . . . and backs these products with a service policy that assures long-range protection to the user.

THE SPICER line meets a large majority of the power transmission needs in passenger cars, trucks, buses, tractors, rail cars, and railway generator drives.

SPICER MANUFACTURING - Division of Dana Corporation - **TOLEDO 1, OHIO**

TRANSMISSIONS • PASSENGER CAR AXLES • CLUTCHES • PARISH FRAMES • STAMPINGS • FORGINGS • TORQUE CONVERTERS • UNIVERSAL JOINTS • SPICER "BROWN-LIPE" GEAR BOXES • POWER TAKE-OFFS • RAIL CAR DRIVES • RAILWAY GENERATOR DRIVES

42 YEARS OF **Spicer** SERVICE

LUNKENHEIMER
Shoulder-Less Steel Valve Seat Rings . . .

- CAN'T WEDGE OUT OF PLACE
- SEAT TIGHTER WITH SERVICE
- ASSURE GREATER BODY STRENGTH
- WILL NOT WARP
- EASILY RENEWABLE

Notice how the inner facing of the Lunkenheimer ring seats squarely against the body wall. There's no flange or shoulder where corrosion can work its way inside — no bending that causes leakage.

This end-seated Lunkenheimer ring *stays put* — won't warp out of place or twist away from the body as it is tightened. See how firmly the heavy ring seals itself into the wall, becoming an integral part of it, adding *extra* strength at the "nerve center," guarding against corrosion.

And this ring actually seats more tightly with years of wear.

Should you ever need to replace it — heavy lugs inside the ring make renewal simply a matter of screwing the old one out, the new one in . . . quickly, without serious production delays.

Before you approve that next order for steel valves in your plant, be sure to double-check seat ring construction. For longer life and lower maintenance costs, specify Lunkenheimer steel valves . . . with *shoulder-less* seat rings.

Write today for your copy of "Lunkenheimer Cast Steels," an informative 52-page brochure on the development and application of steel valve alloys. *The Lunkenheimer Co., Box 360-F, Cincinnati 14, Ohio.*

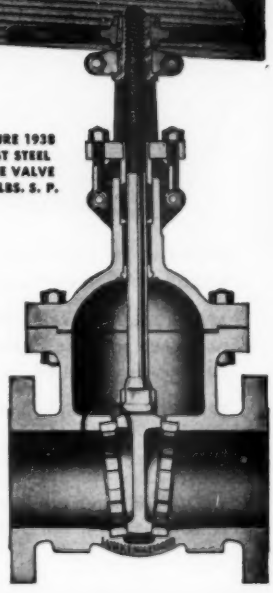


FIGURE 1938
CAST STEEL
GATE VALVE
300 LBS. S. P.

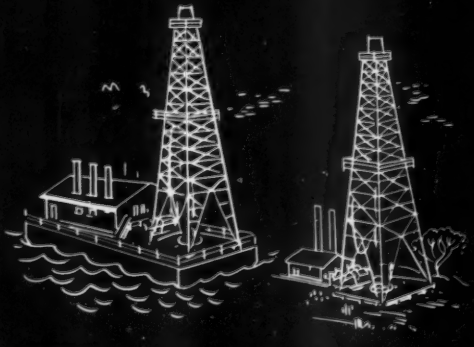
STEEL • IRON • BRONZE

LUNKENHEIMER

THE ONE *Great* NAME IN VALVES

L-451-S

STEAM POWER



For off-shore or inland drilling, power-wise and economy-minded drilling contractors are using Lucey Inside Seal Welded and Double Calked Oil Country Boilers.

Steam is flexible — steam is positive. Steam assures low maintenance and long life. These are the reasons why contractors everywhere, even for the deepest holes, are switching to Lucey Boilers.

Make your next rig a steam-powered rig.

DISTRIBUTORS:

National Supply Company, Toledo, Ohio
Lucey Products Corporation, Tulsa, Oklahoma
Houston Oil Field Material Co., Inc., Houston, Texas
Jones & Laughlin Supply Co., Tulsa, Oklahoma
Murray-Brooks, Inc., Lake Charles, Louisiana
Bethlehem Supply Co. of California, Los Angeles

EXPORT: Lucey Export Corporation, 233 Broadway, New York 7, New York
Broad Street House, E.C. 2, London, England
Lucey Boilers are approved for use in Canada

LUCEY

BOILER *and* MANUFACTURING CORPORATION

CHATTANOOGA, TENNESSEE

1314 CHESTNUT ST.
CHATTANOOGA

LUCEY

1312 STERLING BLDG.
HOUSTON, TEXAS

GM DUAL FUEL BY STEWART & STEVENSON SERVICES CUTS OPERATING COSTS 61% FOR CONTRACTOR

In July of 1950, Stewart & Stevenson Services in conjunction with their Dealer, The Industrial Power & Supply Co. of Longview, Texas, installed two GM Dual Fuel Diesel Engines for B.G. Byars Power Drilling Co. In the first ten months of operation, the engines have drilled approximately 52,000 feet of hole with **a 61% average daily fuel cost saving.** Here's the actual record: Fuel cost of straight Diesel engine operation—600 gallons of diesel fuel at 11½c per gallon per 24 hours at normal operational speeds . . . $69.00 per day.

Fuel cost of dual fuel Diesel engine operation—120 gallons of diesel fuel at 11½c per gallon plus 75,000 cu. ft. natural gas at average cost of 17½c per 1000 feet per 24 hours at normal operational speeds . . . $26.92 per day.

Yes, by merely the flick of a valve, these dependable GM Dual Fuel Diesel Engines can be switched from operation on diesel fuel to operation on natural gas. This insures the lowest cost operation per foot of hole plus diesel dependability, regardless of which fuel is used. And to switch from one fuel to the other, there is no conversion required . . . no heads to change or complicated and troublesome ignition systems to bother with.

Add this new GM fuel flexibility to the established dependability of GM Diesel Engines . . . plus Stewart & Stevenson day-and-night service, experience and "know-how" . . . and you have assurance of the most economical power in the oil fields. Let your Stewart & Stevenson Representative explain in detail, without cost or obligation, the many other advantages of GM Dual Fuel Diesel Engines for your drilling rigs. Call him today!

STEWART & STEVENSON SERVICES, Inc.

3026

Main Office and Plant: 4516 Harrisburg Blvd., Houston 11, Texas. Phone WOodcrest 9691

Branches: Corpus Christi, Dallas, Lubbock, McAllen, Wichita Falls.

Representatives: San Antonio, Waco, Longview, Brownsville, Breckenridge.

Distributors of: General Motors Diesel Engines, Continental Red Seal Engines, Chrysler Industrial and Marine Engines, Chicago Pneumatic Engines, Petter Diesel Engines, Gardner-Denver Pumps.

Fabricators of: Electric Power Units, Electrical Control Equipment, Portable Pumping Units, Truck Bodies, Hurricane Stalk Shredders.

PARTS... SERVICE

STEWART & STEVENSON SERVICES, INC.

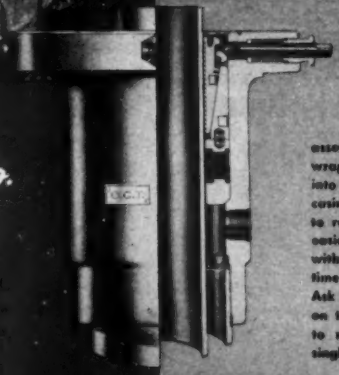
Anytime Anywhere

THE NATION'S LARGEST DISTRIBUTORS OF GM DIESEL ENGINES

WHAT COULD BE EASIER?

. . . than taking candy from a baby or installing a casing hanger from the derrick floor!

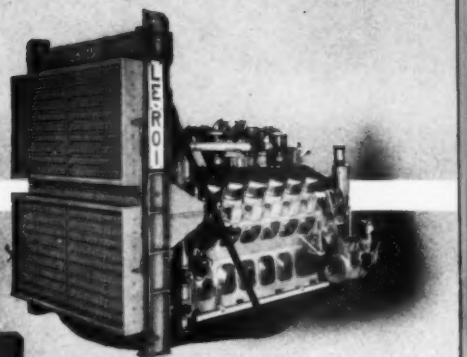
O-C-T "C-19" CASING HEADS HAVE SET A NEW *SAFETY STANDARD* for RIGS AND CREWS



When it arrives at your rig, the O-C-T "C-19" Casing Hanger has been pre-assembled and is ready to install from the derrick floor. So, instead of seven separate pieces to "juggle" and install when hanging pipe, the sealing element, slip bowl and slips in the "C-19" are assembled as a single unit that may be quickly wrapped around the casing, latched and dropped into place in a jiffy. The seal is automatic when casing weight is applied; thus, elevators are released to raise blowout preventers. Now, what could be easier? All the work is done from the derrick floor without leaving any remote possibility open at any time for your well to pressure up and blow out. Ask your O-C-T Representative or write for details on the "C-19" . . . the first slip type casing head to meet every well completion condition with a single compact model!

Oil Center Tool Co.

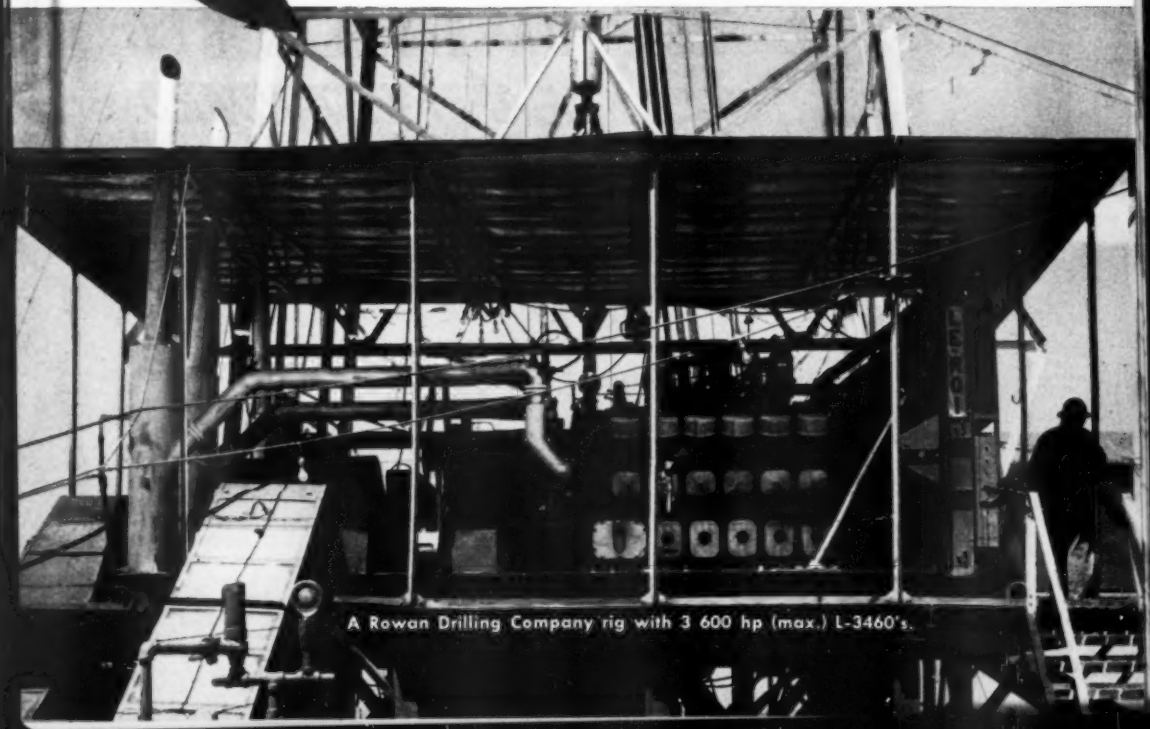
Le Roi 3 way Partnership



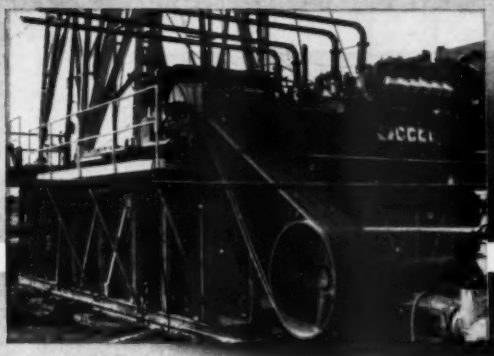
1. **LE ROI gives you Better Engines**—for example the L-3460 with its advanced design, V-12 construction and 600 maximum HP — built to meet oil-field demands for more power. Compactness and a weight of only 12,200 pounds give you an extremely low weight-to-horsepower ratio.

600 hp. L3460's put

(MAX.)



A Rowan Drilling Company rig with 3 600 hp (max.) L-3460's.



2. **EXCLUSIVE LE ROI DISTRIBUTORS give you Better Applications**—distributors who sell Le Roi engines are oil-field power specialists. They know engines. That's why they can select the right power unit for any application. That's why you can count on Le Roi for dependable, low-cost power.

3. **YOU get Better Service**—yes, you get personal attention from engine experts when you deal with exclusive Le Roi distributors — because they handle Le Roi, and only Le Roi! Large parts-stocks and skilled mechanics mean prompt service and a minimum of down-time. Remember, keeping your Le Roi engines running is the sole responsibility of our distributors.

you way ahead of the field

...with compactness, more power, greater speed range, greater accessibility

Here's the last word in oil-field engine design — Le Roi's V-12 L3460 with its wide speed range from 600 to 1350 rpm and horsepowers from 350 to 600. It produces plenty of low-cost dependable power for a wide variety of applications — drilling, pipeline service, power generation, etc.

Rowan Drilling Company, for example, uses 10 of these engines on four different rigs. The advantages, of course, for drill-rig applications are: fast acceleration, plenty of lugging power at low speeds, and compactness.

The L3460 is also a standout for pipeline service. It has unusual dependability and economy under continuous load, space-saving size for easy installation, and easy accessibility that simplifies maintenance.

It pays to use L3460's. Not only do you get oil-field power at its best but you also enjoy the benefits of Le Roi's 3-way partnership. See your Le Roi distributor and find out why better engines, sound applications, and prompt personal service put you ahead of the field.

LE ROI COMPANY

MILWAUKEE 14, WISCONSIN

Plants: Milwaukee • Cleveland • Greenwich, Ohio — Oil Field Headquarters: Tulsa, Oklahoma

LE ROI

See these Le Roi Distributors for a Profitable 3-way Partnership

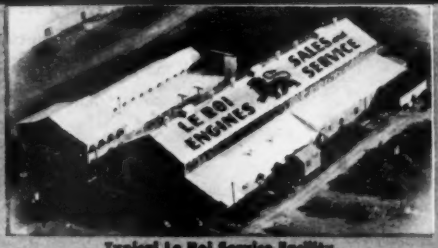
Oklahoma
Le Roi Company Branch—Tulsa
Carson Machine & Supply Co.—Oklahoma City

East & South Texas, Gulf Coast
Southern Engine and Pump Company — Houston, Kilgore, Edinburg, Dallas, San Antonio, Corpus Christi, Texas, and Lafayette, Houma, Louisiana.

North & West Texas, New Mexico
General Machine & Supply Co. — Odessa, Snyder, Texas.
Norlyn Engine & Equipment Co.—Wichita Falls, Texas.

Kansas
Carson Machine and Supply Co.—Great Bend

Illinois — Western Kentucky
Western Machinery & Engine Company—Centralia, Illinois and St. Louis, Missouri.



Typical Le Roi Service Facility

Here's Le Roi's exclusive distributor in Oklahoma—Carson Machine and Supply Company. Centrally located and staffed with plenty of experienced manpower, Carson can give skilled service to any customer in the state within a few hours. Shop facilities are modern and include a dynamometer for testing engines. Complete parts stocks are maintained for all Le Roi engines.

Michigan
Motor Engine Service — Reed City

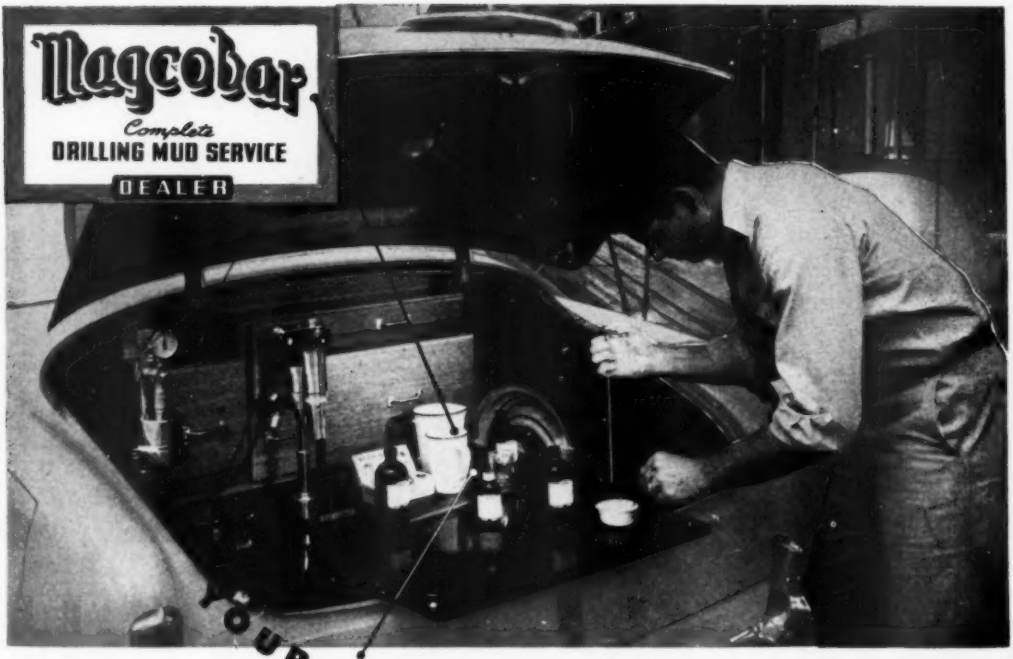
Rocky Mountain Area
Gehring Equipment Co. — Casper, Wyoming, Rangeley, Col.

Northern Louisiana & Mississippi
Ingersoll Corporation — Shreveport, Louisiana, and Jackson, Mississippi.

West Coast
Le Roi-Ric Machinery Co. — Los Angeles, Long Beach and Bakersfield, Calif.

Appalachian Area
P. C. McKenzie Co., Pittsburgh, Bradford.

Canada
Locey Export Ltd. — Calgary, Edmonton, Alberta.



YOUR MAGCOBAR FIELD ENGINEER

is a full time partner

MAGCOBAR
MAGCOGEL
HIGH YIELD
MAGCO-FIBER
XACT CLAY
FIBER SEAL
SALT GEL
MAGCO-PHOS
RED OX
MAGCO-MICA
TANNATHIN
JEL-OIL MUD
JEL-OIL "E"
"E" CONCENTRATE
NOHEEVE
SEAL FLAKES
MY-LO-JEL PRESERVATIVE
QUEBRACHO
CHEMICALS

Write today for your free copy of the booklet, "Magcobar Service . . . in tune with industry needs."

You'll find that your Magcobar mud engineer knows more than just mud. He knows in many cases what you can expect to find in the formations of your bore hole. And he's ready with Magcobar's answer . . . answers proved right in hundreds of other similar wells.

The Magcobar mud engineer is a full time drilling partner of yours. He knows how to help you; he wants to help you and his only business is to help you. From the many types of Magcobar drilling muds and chemicals, he knows which to choose to give you best results.

So when you drill your first hole in a difficult area, contact Magcobar. The Magcobar field engineer, is familiar with the area and can give you benefit of first-hand experience in dealing with the problems to be encountered.

MAGNET COVE BARIUM CORPORATION
ONE OF THE DRESSER INDUSTRIES
MALVERN, ARK., HOUSTON, TEX.

COMPACT... EFFICIENT

PARKERSBURG'S unitized separators are easy to install, require minimum foundation and have all of these superior performance features of the famous Type "S" Horizontal Separators:

No. 5114

- **15 to 20% greater facility for primary separation**
- **Faster discharge of gas-free oil; longer retention of more gaseous liquids.**
- **Incoming fluid broken into largest possible droplets**
- **All entrained liquid removed from gas stream**
- **Skimmer pipe provides additional scrubbing**
- **No-Bleed level controller maintains liquid at any desired level to provide maximum space for gas travel and natural separation.**

PARKERSBURG RIG & REEL COMPANY—Parkersburg, West Va.

• Ask your Parkersburg Representative for complete details about this and other Parkersburg Horizontal Separators.

PARKERSBURG

PRESSURE EQUIPMENT

HORIZONTAL AND VERTICAL SEPARATORS • HYRECO • HYDRACEPTER • SCRUBBERS • TREATERS • HEATERS

Manufactured in Houston, Texas

Lufkin PERFECTION

. . . . IN CRANK COUNTERBALANCING

"LET THE WEIGHTS DO THE WORK"
Illustrated above is a very acceptable method of shifting weights on a Lufkin Pumping Unit. The crank is stopped on an incline, the three bolts are loosened and the lead bar is used as a brake. This operation is quite safe because the weights are equipped with a steel safety lug to prevent sliding off the crank.

Another acceptable method of counterbalancing a Lufkin Unit is to stop the crank on a slight incline, prying the weight along the machined ways of the crank with the aid of a bar. This method is made easy by the notched bottom of the crank slot, enabling the operator to reach the desired position by an easy sliding motion.

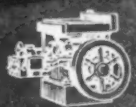
The Lufkin Trout Crank gives perfect counterbalance adjustment from minimum to maximum effect with the greatest of ease. One man can easily do the job. Two methods are illustrated herewith. Any method of moving the weights is safe because the weights are equipped with steel safety lugs to prevent sliding off the crank.

Operators find the Lufkin Trout Crank superior for oil field pumping units because of these outstanding features:

1. **EASE OF ADJUSTMENT**—one man can counterbalance a well.
2. **SAFETY**—a steel safety lug prevents the weights sliding off the crank.
3. **PRECISION** — counterbalance of minimum to maximum effect can be obtained by moving weights in a straight line.
4. **SIMPLICITY**—only three bolts to loosen.

LUFKIN FOUNDRY & MACHINE COMPANY
LUFKIN, TEXAS
Branch sales and service Houston, Dallas, New York, Tulsa, Los Angeles, Seminole, Oklahoma City, Corpus Christi, Odessa, Kilgore, Wichita Falls, Casper, Wyoming, Great Bend, Kansas
Lufkin Equipment in CANADA is handled by
THE LUFKIN MACHINE CO., LTD. 14321 108th Avenue, Edmonton, Alberta, Canada

LUFKIN PUMPING UNITS


LUFKIN-COOPER-BESSEMER ENGINES

LUFKIN OIL FIELD AND INDUSTRIAL TRUCK TRAILERS

INDUSTRIAL SPEED REDUCERS AND INCREASERS

DIVISION LUFKIN FOUNDRY & MACHINE COMPANY
INDUSTRIAL, MILL AND AUTOMOTIVE SUPPLIES

This Costs Money, Too

...and it doesn't make you any friends!

Pipe for utility distribution systems deserves even better protection than pipe for pipelines. For one thing, it costs more to dig up when something goes wrong. Also those noisy pavement-breakers and traffic-snarling holes in the streets don't do your public relations any good.

Sure, factory coated pipe costs a shade more, but it pays off by staying in the ground longer and saving on maintenance expense.

P.S. To our pipe coating plants at Girard and Lorain, Ohio, we have added a third at Hammond, Indiana—centered in the steel pipe mill section of the Chicago Switching District. This location enables our customers in the west and southwest to take advantage of the Hill, Hubbell process with faster deliveries. Minimum freight rates include the privilege of coating and wrapping pipe in transit. The new plant has ample storage space.

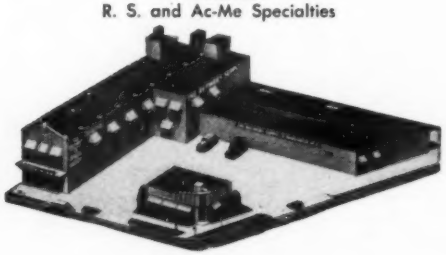
Hill, Hubbell and Company

Division of GENERAL PAINT CORPORATION

Headquarters: 3091 Mayfield Road, Cleveland 18, Ohio

Leaders in Pipe Protection for a Quarter Century

Home of
R. S. and Ac-Me Specialties



Always the Leader in the Manufacture and Distribution of Scientific Instruments for the Oil and Gas Industries

AC-ME AND R. S. SPECIALTIES

- Ac-Me Recording Gravitometer
- Ac-Me Specific Gravity Gas Balance
- Ac-Me Pressure Vacuum Pump
- R. S. Portable Vacuum Pump
- R. S. Mercury Cleaner
- R. S. Manometer
- R. S. Dead Weight Gauge
- R. S. Dead Weight Tester
- R. S. Orifice Well Tester
- R. S. Moisture Tester
- R. S. Flat Bore Yel-O-Bak Thermometers
- R. S. Streamlined Hydrometers
- R. S. Pulsometer
- R. S. Pressure Hydrometer Jars
- R. S. Vapor Pressure Bomb
- R. S. Diamond Core Drill
- R. S. Thermo Plumb Bob Thermometers
- R. S. Thermostat Temperature Controls
- R. S. High Pressure Consistometer
- R. S. Smoke Meters

CENTRAL SCIENTIFIC COMPANY
CHICAGO

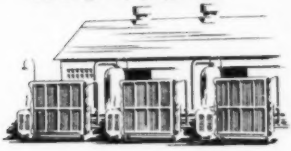
R.S.C. TULSA

REFINERY SUPPLY COMPANY CENCO

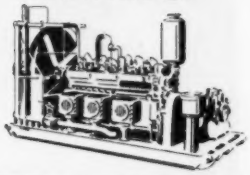
Laboratory Apparatus and Supplies — *Oil and Gas Testing Equipment*

621-23 E. 4th St. Tulsa 3, Oklahoma

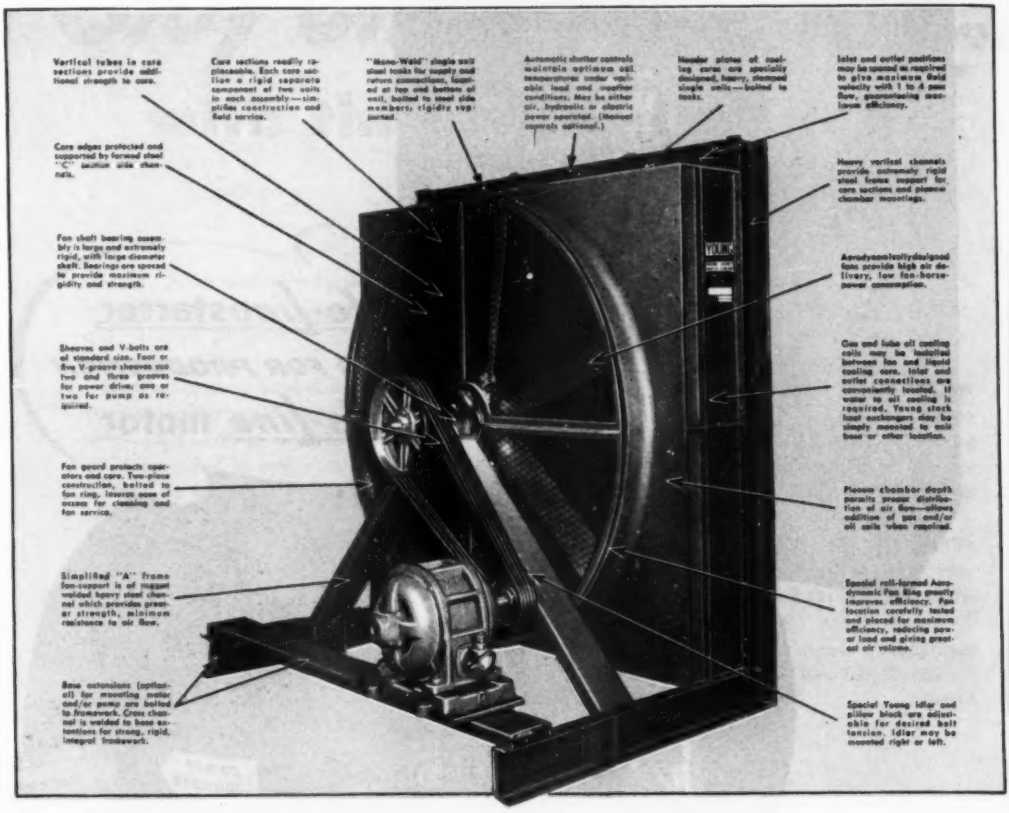
Presenting the New



Jacket Water Coolers



Greater cooling capacity...more compact, rugged design for gas, gasoline, Diesel engine applications . . . . .


Vertical tubes in core sections provide additional strength to core.
Core sections readily replaceable. Each core section a rigid separate component of two units in each assembly—simplifies construction and field service.
"Mono-Weld" single unit steel tanks for supply and return connections, located at top and bottom of unit, bolted to steel side members; rigidly supported.
Automatic shutter controls maintain optimum coil temperatures under available load and weather conditions. May be either air, hydraulic or electric power operated. (Manual controls optional.)
Header plates of cooling cores are specially designed, heavy, channel single units—bolted to tanks.
Inlet and outlet positions may be spaced as required to give maximum field velocity with 1 to 4 pass flow, guaranteeing maximum efficiency.
Core edges protected and supported by formed steel "C" section side channels.
Heavy vertical channels provide extremely rigid steel frame support for core sections and plenum chamber mountings.
Fan shaft bearing assembly is large and extremely rigid, with large diameter shaft. Bearings are spaced to provide maximum rigidity and strength.
Aerodynamically designed fans provide high air delivery, low fan-horsepower consumption.
Sheaves and V-belts are of standard size. Four or five V-groove sheaves and two and three grooves for power drive; one or two for pump as required.
Gas and lube oil cooling coils may be installed between fan and liquid cooling core. Inlet and outlet connections are conveniently located. If water to oil cooling is required, Young stock heat exchangers may be simply mounted to coil base or other location.
Fan guard protects operators and core. Two-piece construction, bolted to fan ring. Insures ease of access for cleaning and fan service.
Plenum chamber depth permits proper distribution of air flow—allows addition of gas and/or oil coils when required.
Simplified "A" frame fan-support is of rugged welded heavy steel channel which provides greater strength, minimum resistance to air flow.
Special roll-formed Aerodynamic Fan Ring greatly improves efficiency. Fan location carefully tested and placed for maximum efficiency, reducing power load and giving greatest air volume.
Base extensions (optional) for mounting motor and/or pump are bolted to framework. Cross channel is welded to base extensions for strong, rigid, integral framework.
Special Young idler and pillow block are adjustable for desired belt tension. Idler may be mounted right or left.

YOUNG

Heat Transfer Products for Automotive and Industrial Applications.

Young Quality T. M. Reg. U.S. Pat. Off.

Heating, Cooling, Air Conditioning Products for Home and Industry.

YOUNG RADIATOR COMPANY

Dept. 201-J • RACINE, WISCONSIN

Factories at Racine, Wisconsin, and Mattoon, Illinois

OIL FIELD DISTRIBUTORS:

TULSA: J. R. Meek Company, 1341 S. Boston St., Rm. 109

LOS ANGELES: Flournoy & Everett Inc., 5043 Santa Fe Ave.

MUSKEGON: Harold J. Young, 206 Montgomery Bldg.

From the many features shown above, you can see that *extra ruggedness* is built into every component of improved Young Jacket Water Coolers. The result is a unit that will last the life of the power plant . . . one that excels in mobile service—that has the necessary compactness and ample capacity for field duty on portable equipment.

Young designing permits the addition of lube oil and/or gas cooling coils between the water cooling core and the fan, making possible a lower fan-horsepower requirement.

Catalog No. 1351 plus ratings, specifications and other details will be furnished upon request. See your nearest Young Distributor, or write direct.

WESTINGHOUSE
Life-Linestarter
PAIRED FOR PRODUCTION
Life-Line motor
WESTINGHOUSE
DO NOT
LUBRICATE

Stay On-Stream longer with this protected pair

Here is a motor and control team especially built for outdoor oil well pumping service. Notice how each is extra protected to guard against rain, snow, sleet.

Look at the outer hood of the motor that gives extra protection against weather. And the controls—AB Circuit Breaker and Life-Linestarter®—are combined in one weatherproof enclosure suitable for pole mounting.

Protection against weather is part of the story. What's more, these two have the stamina to stand up to continuous pumping duty with a minimum of attention.

The Life-Linestarter is years ahead in principle of operation. Only one moving element. Nothing to stick or jam. Vibration, jars or accidental blows cannot cause false operation. Where cycle pumping is required, the built-in time switch handles the "ON" and "OFF" operations automatically. Releases pumper from making periodic trips to the well for manual switching.

You can't get a more rugged motor than the Life-Line. Its steel frame, brackets and feet can take severe shock duty imposed by pumping service. Pre-lubricated bearings need no lubrication . . . eliminate outages due to faulty lubrication.

If it's dependability you want, check these two. They're paired for performance. Ask your Westinghouse representative for copies of "Life-Line Motor Book", B-3842 and "Tomorrow's Starter Today", B-4677, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-21641

YOU CAN BE SURE... IF IT'S
Westinghouse
Life-Line
MOTORS and CONTROLS

Choose MORE than a truck . . .

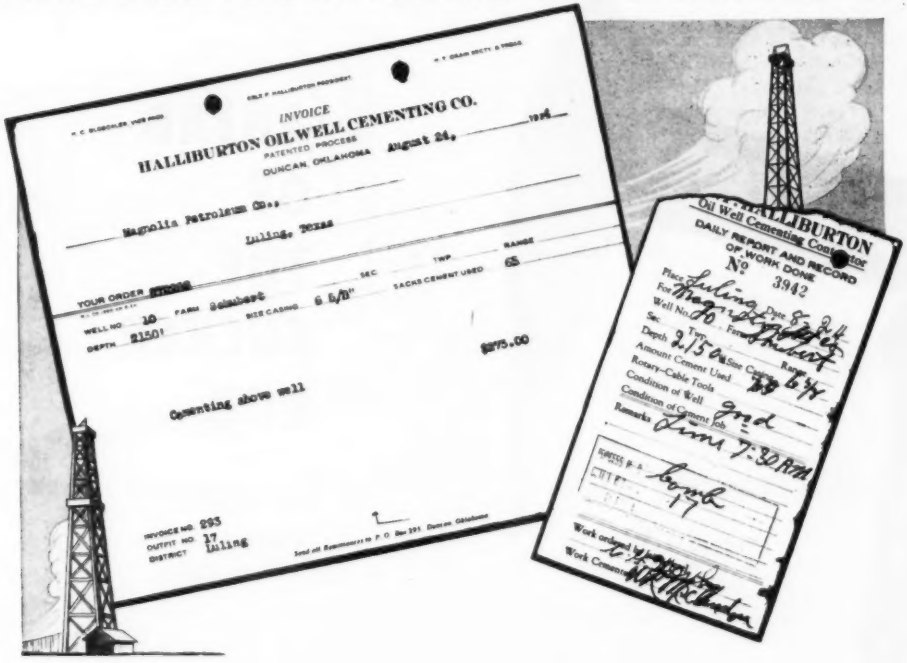
Choose FWD and you choose lower pipe-line costs

Pipeliners discover that choosing FWDs brings important advantages unmatched by either conventional trucks or conversions. First, of course, FWD gives them outstanding performance over all terrain. But FWDs offer BIG EXTRAS . . . including *up to twice* the truck life . . . far less down-time; lower repair costs; more reliable, faster crew service . . . extra safety for men and equipment *on or off* the highway. All these dollar-saving advantages are created because FWDs have the proper distribution of load and power—which *minimizes stress* and furnishes *extra traction* so important in pipe-line work.

To meet your needs, there are FWD models from 14,500 to 60,000 lbs. GVW—4 and 6 wheel drives. For full facts see your nearby FWD Distributor or contact FWD. The Four Wheel Drive Auto Co., Clintonville, Wis. *Canadian Factory:* Kitchener, Ontario. World-wide sales and service.

America's Foremost Heavy-Duty Truck

BY ANY YARDSTICK... CEMENTING PRICES ARE LOW



Many things have happened since the invoice and job ticket reproduced above were written.

The man who signed the job ticket as cementer—W. R. McClendon—is now president of Halliburton Oil Well Cementing Company.

Wells have gone deeper and the price of everything we eat, wear or use has gone up according to the government's Consumers Price Index, which now stands at 185 plus.

But there is one item that is actually LESS today than the figure shown in this long-ago invoice of August 24, 1924—the cost of the average cementing job.

By any yardstick, Halliburton cementing prices are low.

Erle P. Halliburton

Chairman of the Company

HALLIBURTON OIL WELL CEMENTING CO.
Duncan, Oklahoma

AHEAD OF THE SUCKER ROD

First there's financing by the FIRST in Dallas

the Southwest's Pioneer Oil Bank

Give us an opportunity to say Yes

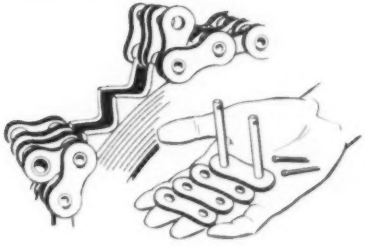
FIRST NATIONAL BANK in DALLAS

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

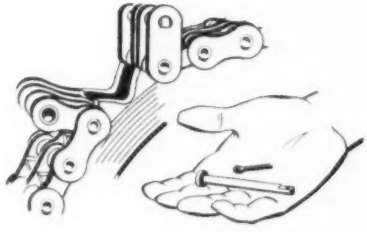
why do it the hard way?

Why struggle with the tough job of assembly, disassembly or repair of standard roller chain, when with Baldwin-Rex "BA" Assembly Roller Chain there's virtually "nothing to it"? "BA" Chain gives you all the advantages of *riveted* roller chain . . . high strength, long life, low cost . . . *plus* even easier assembly, disassembly and repair than with standard cottered chain. With "BA" you gain the advantages of the always high Baldwin-Rex manufacturing standards . . . you save time . . . you save money . . . you can't lose!

Study the illustrations. We think you'll agree that there's no comparison . . . that the "BA" way is the easy way . . . the time-saving way . . . the money-saving way.



With standard roller chain, in order to take the chain apart in the field, it is necessary to drive out the entire pin link with hammer and punch. The pins are struck alternately, and as the side plates are freed, they must be picked up and set aside to prevent loss or damage. There is always the danger of damage to chain parts as the entire pin link is driven out. Assembly presents additional problems. The two pins must be driven back into the chain while three or more side plates (depending on the number of strands) are held in position. You almost need 3 hands to do the job.



With Baldwin-Rex "BA" Assembly, it's an entirely different story. All that is necessary is to remove the cotter and drive out the *single pin* of the special "BA" connector link. The other pin stays firmly riveted in place, preventing the side plates from falling out, thus greatly facilitating the job of reassembly. No danger of damaging parts. Chain is cut by removing only 2 parts . . . the cotter and the single pin connector. To put the chain together, just put the side plates and roller links in place on the sprocket, insert the single pin connector pin and secure with the cotter. That's all there is to it!

EXTRA CONVENIENCE IN ORDERING AND STOCKING, TOO!

The "BA" Assembly is shipped in boxes containing two 5-foot lengths. Each 5-foot length contains two single pin connectors. In addition, a variety of "BA" short units is available. Thus, you or your supply store can quickly and easily make up the exact length of chain to fit your requirements.

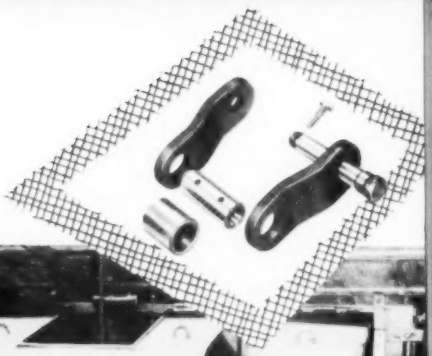
For all the details of the "BA" Assembly, Rex A.P.I. Chains and Rex Oil Field Pumps, send for the new edition of our Oil Field Bulletin 51-8. Write to Chain Belt Company, 1619 W. Bruce Street, Milwaukee 4, Wis.

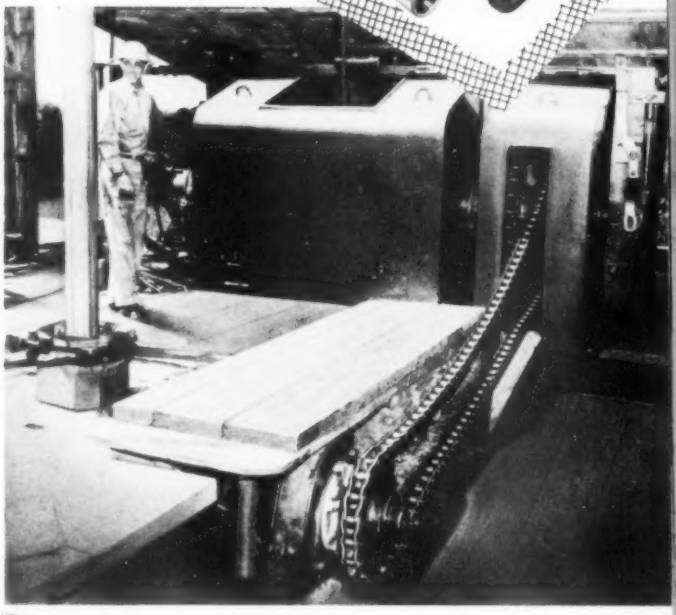
BALDWIN·REX®

ROLLER CHAINS

BALDWIN-DUCKWORTH DIVISION OF CHAIN BELT COMPANY

THE *Secret* OF LONGER CHAIN LIFE





Behind the long life and ability to "take it," which are the "trade-marks" of all Rex A.P.I. Chains, you'll find the famous Rex Unit Link. It's really not a secret. It's just that the quality can't be seen from the surface.

In the Rex Unit Link, pins, rollers, bushings and side bars are made from high quality steel carefully heat-treated to develop maximum strength. These precision parts are then machine assembled to form a link which is *put together to stay*. Each link is exactly alike . . . its precision assembly assures retention of strength and uniformity under even the most adverse conditions.

Side bar holes are machine finished for accurate pitch. There are no sharp corners to start cracking and loosening the pin.

In short, for a chain that gives you longer service life at lowest overall cost, you can't beat Rex!

new look . . new value *IN* OIL FIELD UTILITY PUMPS

The new Rex Self-priming Oil Field Utility Pump not only looks new and different, its outstanding performance makes it the leading value in the field. Five great features combine to put this pump "in a class by itself."

- ★ Extremely simple design.
- ★ All wearing and moving parts accessible with removal of one cover plate.
- ★ Lightweight . . . easily portable, yet really sturdy.
- ★ Simplest, most positive leakproof seal ever designed.
- ★ Patented Adjustable Rex Air Peeler assures "new pump" efficiency for its entire life.

CHAIN BELT REX COMPANY

See it at your nearest supply store.
Rex Oil Field Sales Offices are located in these cities:
New York • Tulsa • Dallas • Houston • Midland • Los Angeles

BALDWIN-REX ROLLER CHAINS

CHAIN BELT COMPANY

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Springfield 2, Mass.

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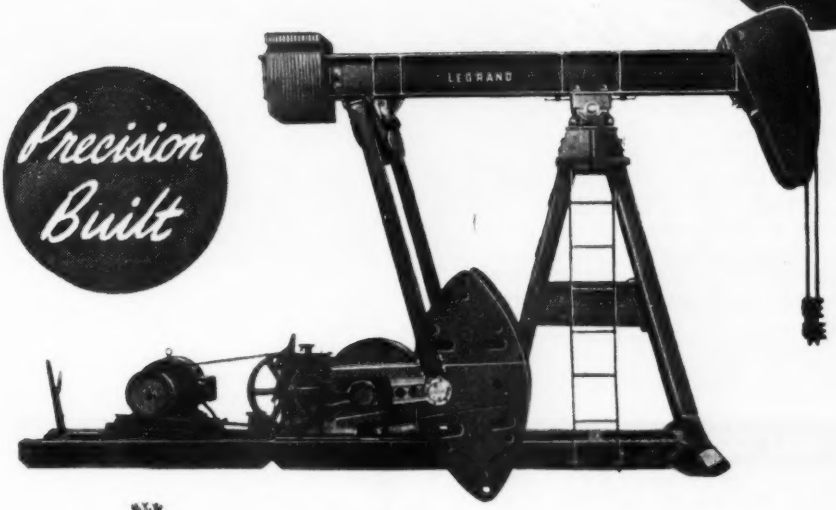
LE GRAND

Best in the Field

Precision Built



THE smooth, rugged power of LE GRAND precision built pumping units gives a field efficiency that ensures constant production with low maintenance costs.

Le Grand units, robust in construction, embody features consistent with sound design, reliable service, and the exacting requirements of the variable conditions found in the World's oilfields. Le Grand are also manufacturers, under license, of the Oil Center Tool Company's well head and ancillary equipment.

OILFIELD EQUIPMENT

LE GRAND SUTCLIFF & GELL LTD

HORSTED AIRPORT · ROCHESTER · KENT · ENGLAND

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Happy Brings You Another "FIRST"

Rotocured V-Belts

Happy — the buy-word in OIL FIELD TRANSMISSION for more than 32 years — now brings DRILLING CONTRACTORS the full value of its experience in tough belting problems . . . with the EXCLUSIVE BWH ROTOCURED V-BELTS. ROTOCURE is the process of continuous vulcanization developed and patented by BWH which insures UNIFORM CURE, UNIFORM STRETCH and eliminates Weak Spots or over-cured sections in the belt

HAPPY BULL DOG V-BELTS

- Have "Bulldog Ruggedness" to absorb shocks and carry the load.
- Have low stretch, giving less slippage, longer life.
- Have extra-heavy, wear-resistant, bias-cut covers to protect the heart of the belt and cut down on replacement costs.

HAPPY "SURE-GRIP" SHEAVES

- Give positive fit on the shaft. Interchangeable QD Type Hub.
- Make required speed changes faster, safer, easier, CHEAPER.
- HAPPY "Sure-Grip" Sheaves with HAPPY Bull Dog V-Belts will help you reduce operating costs. They have been PROVEN on tough jobs.

The HAPPY COMPANY
Formerly HAPPY BELTING COMPANY
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Complete Stocks available in all HAPPY Stores

SERVING FOR . . .

BWH Industrial Hose
Happy Coolers
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32 HAPPY YEARS

BRANCH STORES:

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Odessa	Texas
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DISTRICT REPRESENTATIVES:

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They Say—

Sympathetic Nebraskans

"Geographically, Sidney is sitting in a perfect position to capitalize on the discoveries which have been made. We are adjacent to most of the important oil fields which have been found and we are in the dead center of proved gas reserves.

"Unless we go sound asleep, there is no way we can miss becoming an important oil center. Our biggest responsibility is in recognizing the problems of the oil companies now doing business here, and in using our influence, resources, and personal efforts to see that these problems are satisfactorily resolved. We would be most negligent if we failed to recognize and embrace these problems."

Editorial in the Sidney, Neb., Telegram.

Common Carriers Championed

Sir:

In the editorial . . . "Common-Carrier Fetish," (August 16) in which you took to task the Interior Department for their "campaign" to enforce the common-carrier requirements incident to the operation of natural gas and other types of pipe lines operating across public domain, it is my considered opinion that your attitude is completely arbitrary and based on a complete lack of knowledge of the facts incident to not only the gas business but to the oil business as well.

If you will take the time and effort necessary to investigate the actual historical facts . . . you will come to the inevitable conclusion that the reason or reasons the oil business is today in its admirable economic condition . . . is occasioned entirely by the enforcement of the common-carrier phase of the inter- and intra-state oil pipe lines.

Further . . . you will find that the reason there is no competition and no basic economic security in the natural-gas business from the producers' standpoint is occasioned by the fact that the common-carrier phase of the natural-gas pipe-line companies' operation has never been enforced, with the exception of one isolated instance (e.g.: Montana-Dakota Utilities Co. System, Montana and the Dakotas).

The operations of all the major and minor natural-gas companies are monopolistic in the full meaning of the word, in that they buy only gas they so desire to buy and transport only that gas which they have purchased themselves and, therefore, have made the drilling for and production of natural gas by individuals

IF YOU'RE NOT USING

"FIST-GRIP" CLIPS

YOU'RE ASKING FOR TROUBLE! Here's Proof!

WRONG and RISKY!

Tightening of nuts on ordinary U-bolt clips pulls wire rope into bowed shape, crushes rope, endangers safety.

In use, rope between U-bolt clips is crimped under tension, leading to further damage and early breakage.

Laughlin "Fist-Grip" Safety Clips grip the rope in four bearing-surfaces, holding it straight without damage or distortion.

Keeping the rope straight under working tension, "Fist-Grip" Clips deliver 95% to 100% of the rope's rated breaking strength.

RIGHT and SAFE!

You Get All These Benefits Only With "FIST-GRIP" Clips

Won't crimp or crush — pre-formed or regular lay wire rope; leaves them full strength for safety and longer life.

Simple, easy to put on — saves time, manpower; can be put on with *any* type wrench.

100% foolproof — can't be put on backward.

Sure grip — two clips do the work of three.

Extra strength and safety — only type of clip where entire clip, including bolts, is drop-forged.

Distributed through mine, mill and oil field supply houses.

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VICTAULIC...
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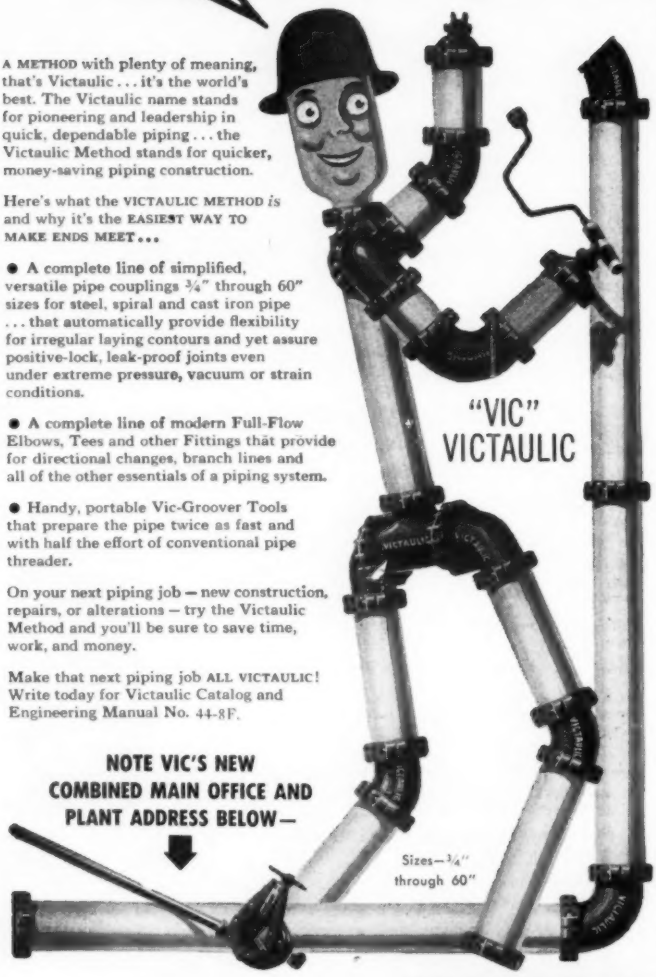

A METHOD with plenty of meaning, that's Victaulic . . . it's the world's best. The Victaulic name stands for pioneering and leadership in quick, dependable piping . . . the Victaulic Method stands for quicker, money-saving piping construction.

Here's what the VICTAULIC METHOD *is* and why it's the EASIEST WAY TO MAKE ENDS MEET...

- A complete line of simplified, versatile pipe couplings ¾" through 60" sizes for steel, spiral and cast iron pipe . . . that automatically provide flexibility for irregular laying contours and yet assure positive-lock, leak-proof joints even under extreme pressure, vacuum or strain conditions.
- A complete line of modern Full-Flow Elbows, Tees and other Fittings that provide for directional changes, branch lines and all of the other essentials of a piping system.
- Handy, portable Vic-Groover Tools that prepare the pipe twice as fast and with half the effort of conventional pipe threader.

On your next piping job — new construction, repairs, or alterations — try the Victaulic Method and you'll be sure to save time, work, and money.

Make that next piping job ALL VICTAULIC! Write today for Victaulic Catalog and Engineering Manual No. 44-8F.

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27TH VICTAULIC YEAR

The easiest way to make ends meet
VICTAULIC
PIPE COUPLINGS AND FITTINGS

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or companies, themselves, so completely uneconomic that to date it is virtually impossible to even finance the drilling of a gas well.

As to your remarks concerning the capacity factor in these interstate gas-transmission lines, the latest stipulation required by the Secretary of Interior of the pipe-line companies requires further that the shippers of gas, under common-carrier principles, must furnish valid production contracts, 20-year reserves, and valid consumer contracts before they may request either space and enlargement of the present facilities; thereby assuring the payout of the space whether present unused space or increased space necessitated by this demand. . . .

Chuck Aston,
Consulting petroleum geologist,
Los Angeles.

Plenty of Oil

"The undiscovered reserve of petroleum and natural gas in the United States is large. I do not believe any prudent man would attempt to estimate how much, but the point can be convincingly made by geologists that there remains enough oil to be discovered within the economic reach of the drill in the United States to last for generations to come.

"Our greatest danger is not that the petroleum will fail to show up if we look for it; rather in our possible failure to keep everlastingly looking for it.

"The job is becoming more difficult but it can be done through acceleration of the exploration effort within the oil industry. This will require new cost thinking in money, materials, and exploration manpower.

"The American Association of Petroleum Geologists, with a world wide membership in excess of 8,000, is in reality the oil-finding group of the petroleum industry."

Frank A. Morgan, president, A.A.P.G., and head of Richfield Oil Corp., Los Angeles.

CALENDAR

September

Independent Natural Gas Association of America, annual membership meeting, Skirvin Hotel, Oklahoma City, September 24.

American Association of Oilwell Drilling Contractors, eleventh annual meeting, Texas Hotel, Fort Worth, September 24-25.

American Society of Mechanical Engineers, sixth petroleum mechanical-engineering conference, Mayo Hotel, Tulsa, September 24-26.

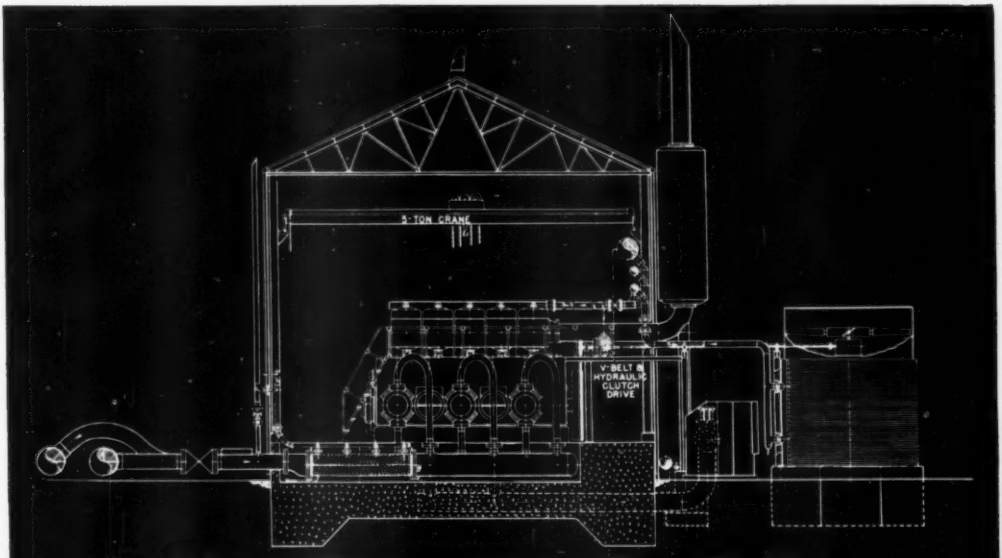
American Society of Mechanical Engineers, fall meeting, Radisson Hotel, Minneapolis, September 25-28.

Texas Independent Producers and Royalty Owners Association, midyear directors' meeting, Tyler, September 28.

October

American Institute of Mining and Metallurgical Engineers, petroleum branch, fall meeting, Oklahoma City, October 3-5.

California Natural Gasoline Association,



More Horsepower Per Dollar

with a

Pritchard-Built Unitized Gas Compressor Station

The Unitized gas compressor station shown above in cross section, is Pritchard's answer to the Natural Gas Industry's demand for increased efficiency and flexibility at lower cost per compression horsepower.

In this design, each engine compressor unit is made as nearly an independent unit as possible, with its own radiator-type jacket water cooler, oil to gas cooler and water circulating pump. As the line load varies, independent units may be added to or removed from service at will.

You are invited to make use of Pritchard's diversified experience in the Gas Engineering field in the design, engineering and construction of *modern* compressor stations or other facilities.

These Pritchard GAS ENGINEERING Services are Available To You

- Compressor stations and additions
- Pressure maintenance units
- Natural Gas Dehydration
- Desulphurization, amine type
- LP-Gas Installations
- Conditioning and treating
- Cooling and heat transfer
- Removal of liquids and dust
- Storage of Natural Gas on solid adsorbents

Chemical Division
Power Division
Petroleum Division
Natural Gas Division

NATIONAL CONSTRUCTORS ASSOCIATION — MEMBER

Write for Bulletin No. 61.92.001

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Pyrene* Air Foam is the most positive agent for killing flammable liquid fires—everything from small spill fires to fires in large flammable liquid storage tanks. Quickly, easily applied by portable playpipes or fixed or portable foam makers. Guards against flash-backs and re-ignition. Economical and efficient —even where water supplies are limited.

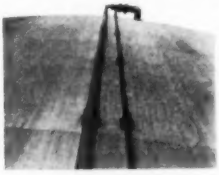
*T.M. Reg. U.S. Pat. Off.

FOAM PLAYPIPES

For use on any hoselines where water under pressure flows at 20 or more gals. per min. Compound can either be fed to water stream through pick-up tube or carried to playpipe as pre-mixed solution. Capacities 200 to 1,600 gals. per min.

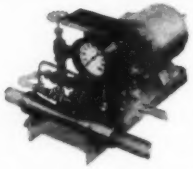
PROPORTIONING TANKS

Automatically proportion foam compound into water stream. Mobile and stationary units in 10, 20, 40 gal. capacities. For smaller tanks (to 35' dia.), loading racks and docks, pump rooms, oil barges, petroleum products storage warehouses, general spill protection.



AUTO INDUCTION SYSTEMS

For small groups of tanks with limited pipe runs, too large for proportioning tank systems and where only source of energy is water pressure. Valuable also for converting of existing chemical foam systems.

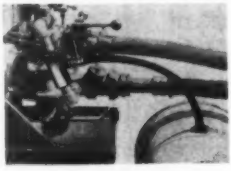


PRESSURE LINE INDUCTORS

For use in mobile or fixed systems where large foam volume is needed and long pipe runs are involved. May be connected to foam makers, playpipes and portable foam towers.

FORCING TYPE FOAM MAKERS

For hazards where foam, after being generated, may be forced several hundred feet to discharge spilled. Ideal for crash trucks and mobile fire apparatus. Portable and stationary types, various capacities.



AROUND THE PUMP PROPORTIONERS

An economical method for using part of water from pump discharge to proportion and introduce foam compound into water line. Maximum allowable suction pressure is 70 psi.

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twenty-sixth annual fall meeting, Ambassador Hotel, Los Angeles, October 4-5.

Texas Mid-Continent Oil and Gas Association, annual meeting, Hotel Beaumont, Beaumont, Tex., October 8-9.

American Oil Chemists' Society, fall meeting, Edgewater Beach Hotel, Chicago, October 8-10.

National Safety Council, thirty-ninth national safety congress and exposition, Stevens Hotel, Chicago, October 8-12.

Indiana Independent Petroleum Association, fall convention, Hotel Severin, Indianapolis, October 13-14.

Oil Progress Week, October 14-20.

National Association of Corrosion Engineers, Permian Basin Corrosion Tour, Odessa, Tex., October 15-16.

American Petroleum Credit Association, twenty-seventh annual conference, Adolphus Hotel, Dallas, October 15-17.

American Gas Association, annual convention, Kiel Auditorium, St. Louis, October 15-17.

National Metal Congress and Exposition, American Society for Metals, American Welding Society, American Institute of Mining and Metallurgical Engineers, and Society for Non-Destructive Testing, Hotels Statler, Book-Cadillac, and Detroit-Leland, Detroit, October 15-19.

Institute of Gas Technology, annual meeting, Chicago, October 18.

American Chemical Society and Southern Association of Science and Industry, Southwide Chemical Conference, Wilson Dam, Ala., October 18-20.

National Association of Corrosion Engineers, South Central Region, annual meeting, Corpus Christi, Tex., October 18-20.

American Association of Petroleum Geologists, regional meeting, Commodore Perry Hotel, Austin, Tex., October 18-20.

Natural Gasoline Association of America, southern regional meeting, Blackstone Hotel, Tyler, Tex., October 19.

American Institute of Chemical Engineers, sixth annual South Texas Section technical meeting, Hotel Galvez, Galveston, October 19.

Independent Petroleum Association of America, Shamrock Hotel, Houston, October 21-23.

American Institute of Electrical Engineers, fall general meeting, Hotel Cleveland, Cleveland, October 22-26.

Fifteenth Penn State Technical Conference on Petroleum Production meeting at State College, Pa., October 24-26.

Society of Exploration Geophysicists, eastern regional meeting, Webster Hall Hotel, Pittsburgh, October 25.

American Institute of Mining and Metallurgical Engineers, petroleum branch, annual meeting of West Coast chapter, Elks Club, Los Angeles, October 25-26.

Society of Automotive Engineers, diesel-engine division, Drake Hotel, Chicago, October 29-30.

American Institute of Mining and Metallurgical Engineers, fall meeting of all branches in connection with Mexican Bureau of Mines, Hotel Del Prado, Mexico City, October 29-November 3.

Society of Automotive Engineers, fuels and lubricants division, Drake Hotel, Chicago, October 31-November 1.

November

Louisiana-Arkansas Division, Mid-Continent Oil and Gas Association, twenty-ninth annual meeting, Roosevelt Hotel, New Orleans, November 1-2.

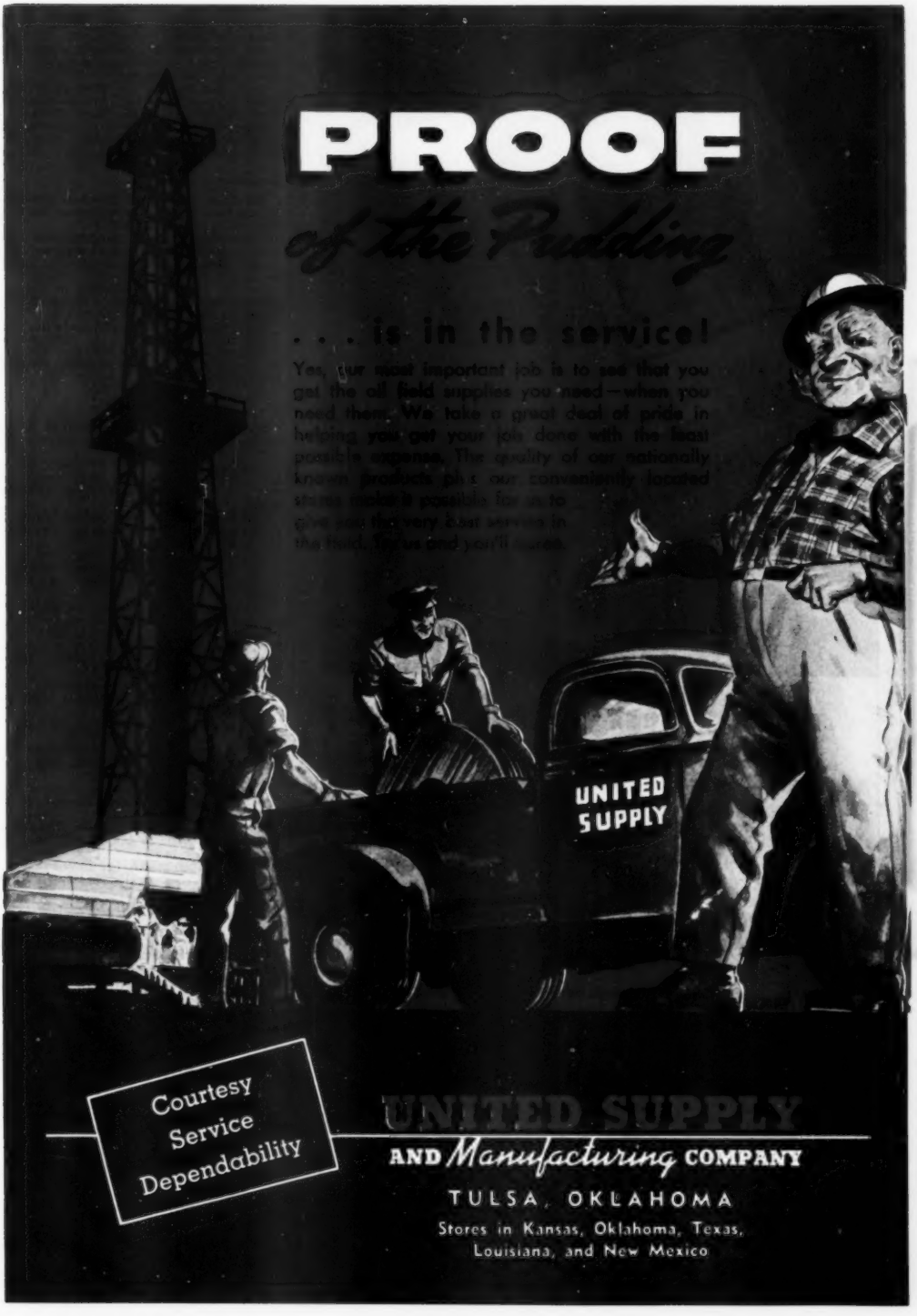
American Association of Petroleum Geologists, Pacific section annual fall meeting, Ambassador Hotel, Los Angeles, November 1-2.

American Petroleum Institute, thirty-first annual meeting, Stevens Hotel and Palmer House, Chicago, November 5-8.

Southwest Research Institute, second conference on coastal engineering, Rice Hotel, Houston, November 7-10.

Gulf Coast Association of Geological Societies, first annual meeting, Roosevelt Hotel, New Orleans, November 15-17.

Rocky Mountain Oil and Gas Association, annual meeting, Cosmopolitan Hotel, Denver, November 15-17.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MUNDET 85% MAGNESIA INSULATION provides maximum strength and resistance to vibration. Extra durability is built into this insulation. In pipe covering and blocks, it is precision manufactured on the latest type of automatic equipment to insure uniform standards. It does not "powder", settle or disintegrate. It is unaffected by steam or water leakage. It maintains an attractive, smooth finish. Precision pipe fit is assured, with no spaces left for the escape of heat. You benefit from the most modern manufacturing facilities for the production of heat insulation when you specify Mundet 85% Magnesia Pipe Covering and Blocks.

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INSULATION FOR HIGH & LOW TEMPERATURE

Society of Exploration Geophysicists, regional meeting, Baker Hotel, Dallas, November 19-20.

Mid-Continent Oil and Gas Association, annual board of directors meeting, Tulsa Club, Tulsa, November 20.

American Society of Mechanical Engineers, annual meeting, Chalfonte-Haddon Hall, Atlantic City, November 25-30.

Twenty-third Exposition of Chemical Industries, Grand Central Palace, New York City, November 26-December 1.

December

American Institute of Chemical Engineers, annual meeting, Chalfonte-Haddon Hall, Atlantic City, December 2-5.

Chemical Specialties Manufacturers Association, thirty-eighth annual meeting, Mayflower Hotel, Washington, D. C., December 3-4.

Natural Gasoline Association of America, Panhandle-Plains regional meeting, Herring Hotel, Amarillo, Tex., December 7.

New York Oil Heating Association, Inc., Hotel Statler, New York City, December 10.

American Association for the Advancement of Science, annual meeting, Philadelphia, December 27-28.

1952 Meetings

Society of Automotive Engineers, annual meeting, Hotel Book-Cadillac, Detroit, January 14-18.

American Association of Petroleum Geologists, Rocky Mountain Section, second annual convention, Salt Lake City, February 28-29.

American Society for Testing Materials, spring meeting, Hotel Statler, Cleveland, March 3-7.

National Association of Corrosion Engineers, eighth annual conference and exhibition, Galvez Hotel, Galveston, Tex., March 10-14.

American Institute of Chemical Engineers, regional meeting, Atlanta, March 16-19.

American Petroleum Institute, Division of Production, Mid-Continent district meeting, Broadview Hotel, Wichita, Kans., March 19-21.

Southwestern Gas Measurement Short Course, University of Oklahoma, Norman, April 8-10.

Southern Gas Association, annual convention, Galveston, Tex., April 28-30.

American Institute of Chemical Engineers, regional meeting, French Lick, Ind., May 11-14.

American Gas Association, Natural Gas Department spring meeting, Biltmore Hotel, Los Angeles, May 12-13.

American Petroleum Institute, Division of Refining, seventeenth midyear meeting, San Francisco, May 12-15.

American Gas Association, production and chemical conference, Hotel New Yorker, New York, May 26-28.

Canadian Gas Association, Chateau Frontenac, Quebec, June 8-12.

American Petroleum Institute, midyear standardization meeting, Brown Palace Hotel, Denver, June 9-14.

American Society for Testing Materials, annual meeting, Hotel Statler, New York, June 23-27.

NOMADS

Tulsa Nomads, third Friday of each month. After Five Room, Tulsa Hotel.

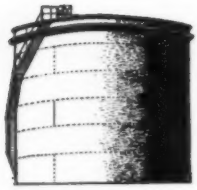
Dallas - Fort Worth Nomads, first Monday of each month, Greater Dallas Club.

Houston Nomads, second Monday of each month, Ye Ole College Inn, Houston.

Los Angeles Nomads, second Wednesday of each month, Jonathan Club.

New York Nomads: October 1 and October 29, regular meetings, Louis Sherry's; December 8, Christmas dinner dance, Hotel Pierre.

Our 19th Year *as an integrated geophysical research organization brings assurance of accurate interpretation of data obtained by experienced, closely supervised crews, working with the most modern instruments and techniques. Seismic Explorations, Incorporated, 1007 South Shepherd, Houston, Texas.*



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RADIALLY WELDED DECK ELIMINATES BUCKLES AND PUDDLES

DAM BLOCKS WATER, SLUDGE. REMOVABLE FOR EASY FLUSHING

Now—for the first time, a floating roof that utilizes *Full Tank Height!* When empty, the roof actually rests on the tank bottom without pipe supports. The *Full Travel* enables you to utilize the full capacity of the tank for conservation storage.

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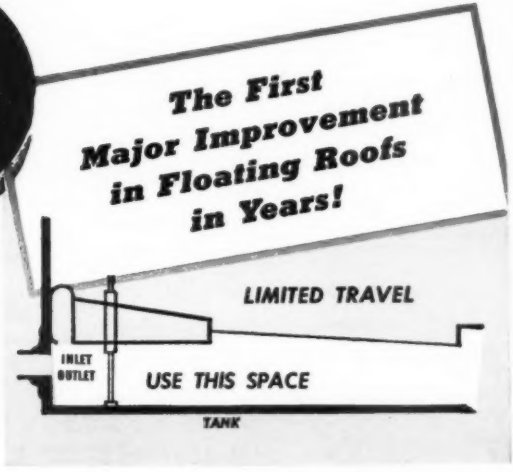

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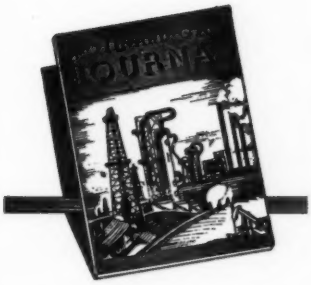

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JOURNALLY Speaking

Giving Us "H"

A LETTER signed "Uintah Liz" and postmarked Vernal, Utah, takes our favorite oil publication to task for its spelling of an area fast coming to the notice of the oil industry. Pencils Liz:

"Those cowpokes in Wyoming just don't know how to spell Uintah. To them it is Uinta, but here it is Uintah County, mountains, and basin. Please correct your copy.

"Those whistle-stop towns of Denver, Casper, and Billings are scrapping for the title of 'Rocky Mountain Oil Capital,' but any town can grow with the help of a railroad but it takes a small town like Vernal, 122 miles from the nearest railroad, to show them how.

"It is not news when oil discoveries are made in Texas, Oklahoma, and Wyoming. That is where oil is supposed to be. But in the Uintah basin, where there never was any oil, and if there ever was any it all went down the river 36,569,742 years ago, or oozed into the up-and-down cracks they call 'fissure veins' that opened up 2 years later when the country was voted dry, that *is* news when the bit gets greased here.

"This dried oil, Gilsonite, acted as a cementing material, and is the only thing that held the country together until the New Deal took over.

"Those oil bugs were not supposed to have laid any eggs in that Tertiary, continenal, lacustrine (whew!) stuff and it is a good thing that that hard-headed Carter bunch can't read or they never would have had the nerve to dig here.

"Now everybody is 'discovering' the basin, even oil-state governors and ex-presidential candidates. Texans are wondering how this basin ever got away from them. We wouldn't be a bit surprised if the Duchesne 2 Ute Tribal would flow sealed 1-lb. cans of cup grease."

So be it. We will let Denver, Wyoming, and Carter Oil Co. make their own replies to Uintah Liz's outburst of local pride, but we rise to defend our ability to spell.

According to all the reference works on geography and orthography available in what Vernal doubtless considers this whistle-stop erstwhile oil capital of Tulsa, the following are correct: Uinta County, Wyoming; Uintah County, Utah; Uinta Mountains, Utah; Uinta Indian Reservation, Utah; Uinta National Forest, Utah. And our geological authorities are equally unanimous that there is no "h" on Uinta basin, Uintah Liz to the contrary notwithstanding.

We won't attempt to explain the mystery of the vagrant aspirate. Maybe some of those early Mormon settlers were English and dropped their "h's."

Paid Rubbernecker

ONE of our spies reports that Standard Oil Co. of California has employed a man to just roam around the country visiting museums. Nice work if you can get it. Here thousands of Americans spend their vacations and their year's savings visiting museums in Europe and everywhere else, and this guy gets paid for it.

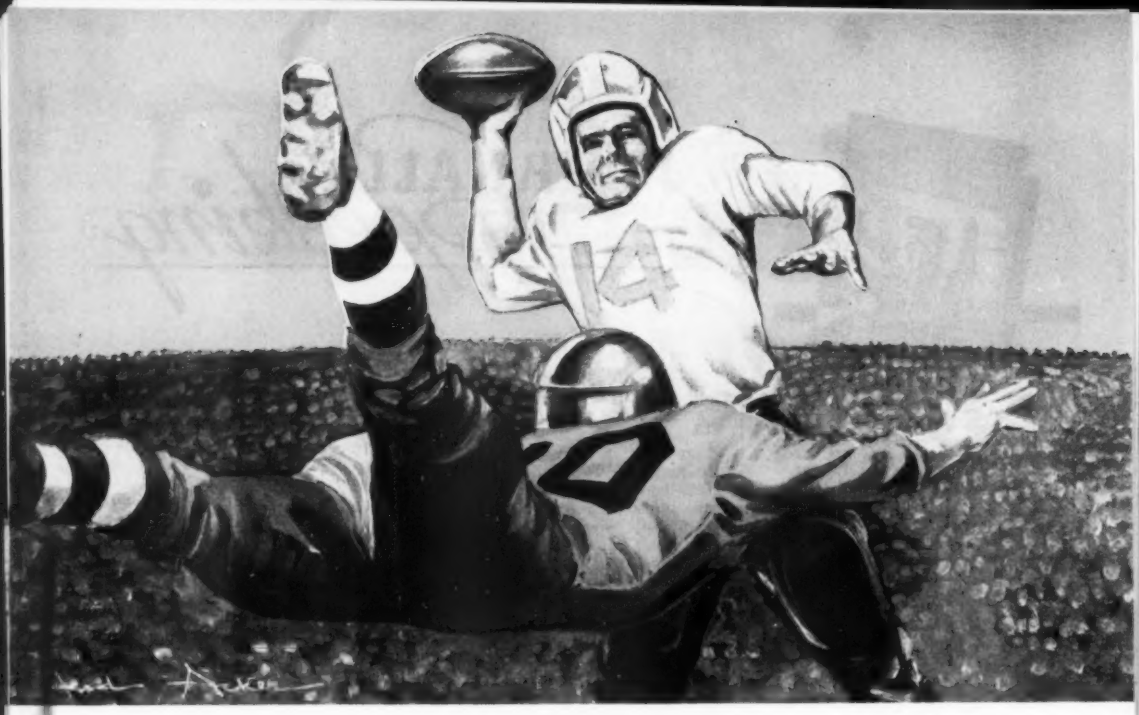
But there's method in this madness, just as in most of the crazy-appearing things oil men do. As we get it, Socal is thinking of setting up some sort of a permanent historical exhibit. So this man is out looking for ideas, and examples of industrial museums in general and oil museums in particular. Only trouble is, he hasn't been able to find many oil museums, except for the one at the site of the Drake well.

It seems that oil companies, as a rule, don't hang on to their mementos and memorabilia, so they wouldn't have much to display in their museums if they ever felt like opening any. But since rubbernecking into glass cases is a Great American Pastime, a few strategically located oil museums wouldn't be a bad way to tell the story of petroleum's progress.

Nifty Name

WE hate like sin to admit that any good idea could come out of Russia, but we understand that the Russian name for L.P.G. is "nieftiegas." Probably a derivative of the same root as our word naphtha, but we would pronounce it "nifty gas" and that seems like a lot more apt and less cumbersome name than liquefied petroleum gas.

—*Henry D. Ralph*



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Making Hole

Old Mother Earth has never been punched so full of holes as at the present time when 2,700 active rotary rigs are completing an average of 900 wells per week in the United States. This unprecedented drilling activity is the industry's response to the national need for a reserve producing capacity for petroleum.

What enabled the industry to expand its activity so greatly was the fact that most of the drilling is done by independent, competitive drilling contractors—more than 900 of them, owning from 1 to more than 50 rigs each. These "small businesses" within the giant petroleum industry provide an elasticity which could not be approached if all drilling were done by the drilling departments of a few big producing companies.

Drilling is probably the most competitive segment of the competitive oil industry, which is a good thing for the industry as a whole and for the public, but tough on the drilling contractors. When activity is low they are apt to cut their own throats by bidding below cost, and when activity is high they are plagued with shortages and the pressure for speed.

At present the shortage of materials, for all the talk about it, is less troublesome than the shortage of manpower. Contractors are scouring the country for labor, upgrading older employes to higher positions, and running with short crews. In spite of this they are making more hole than ever before and this is due in no small part to the personnel-training programs which most contractors conducted when time was less pressing.

If the law of supply and demand is operating, drilling contractors should have no complaints about business and prices this year. Rigs are in great demand, and contractors are in position to make their prices cover their costs if they ever will be. But there is still sufficient competition to keep prices from getting out of hand, and the accounting methods the drilling industry has worked out in recent years can prevent too high prices as well as keeping contractors from bidding below cost during slacker periods.

One big reason why the industry is making hole fast these days is the great progress in drilling equipment and methods which has been made in recent years. Research and experimentation by equipment manufacturers, producing companies, and contractors themselves have contributed to this. The present call for more wells is bringing wider application of new methods to increase efficiency and speed performance.

The rate at which new wells are being completed has astonished many people who predicted it couldn't be done. There are more rigs running than some people thought existed, and the operators are managing to get the steel and the men to keep on making hole. Thanks to the resourcefulness bred of competition, the industry is setting new records in drilling in spite of adverse conditions.

THIS WEEK

MAKING HOLE.—At the peak of the greatest drilling program in history, drillers take time out this weekend to gather at Fort Worth for the annual meeting of the American Association of Oilwell Drilling Contractors. This issue of the Journal is largely devoted to special articles to help drillers make hole faster.

REFINING—Refiners attending N.P.A. meeting learn basic reason for lag in million-barrel refining-capacity increase is insufficient materials. . . . ¶Coprecipitated catalyst composed of chromia and alumina will be used in new Thermofor catalytic reforming process. . . . ¶Petrochemicals to enjoy tremendous growth in next 10 years, Texaco chemists predict. . . .

INTERNATIONAL—Iran contracts with Afghanistan to sell 300,000 bbl. of products. . . . ¶Dahl M. Duff, Journal's International editor, now on Middle East tour. . . . ¶Operating companies oppose proposed Peruvian petroleum law. . . .

INDUSTRY—Washington working out comprehensive plan for rationing of civilian gasoline in event of all-out war. . . . ¶Survey of 30 oil companies representing two-thirds of petroleum industry reveals outlook is bright. . . . ¶B. L. Majewski heads firm which buys Chicago marketing facilities of Deep Rock Oil Corp. . . . ¶Jennings, La., sets observance of fiftieth anniversary of oil discovery in Louisiana. . . .

TRENDS—Demand for major petroleum products from United States refineries for 10-week period ended September 8 was 8.7 per cent greater than in same period last year. . . . ¶Gasoline was up 10.3 per cent. . . . Kerosine gained 4.8 per cent. . . . Distillate gained 11.9 per cent. . . . Residual increased 3.1 per cent. . . .

SUPPLY AND DEMAND—Over-all shortage of petroleum products in the United States possible before end of 1951; big inventories may create soft market in inland areas. . . . ¶Compact Commission told that high-level United States crude output, withdrawals from stocks will help offset Iranian loss only until December; thereafter, world shortage looms. . . . ¶Imports of petroleum during July into the United States decreased, but exports rose sharply. . . .

PRODUCTION—Drop in bottom-hole pressures in parts of Canyon reef fields prompts Texas Railroad Commission to order production tests for Diamond M, Kelly-Snyder fields. . . . ¶Navy Department announces plans to drill three wells in Teapot Dome.

TECHNOLOGY—Instruments play vital part in discovery of oil and gas and their use is rapidly increasing, I.S.A. told. . . . Use for automatic control and measurement praised. . . . ¶Refinery control problems, development of instruments discussed by Texas A. & M. symposium. . . .

MATERIALS—Squeeze on metals, other materials vitally needed by petroleum industry gradually getting tighter; shortages of steel, lead for TEL, copper, quebracho increasing; nickel becoming scarce. . . . ¶Cutdown on nickel may result in inferior rock bits for drilling. . . .

ACTIVITY—Crude production averaged 6,200,500 bbl. daily for week ended September 15, down 5,850 bbl. daily. . . . ¶Well completions dropped to 865 from 892 a week earlier. . . . Wildcat completions increased 4 wells to 865. . . . ¶Still another new high was reached by rotary rigs operating in the United States on September 10, a total of 2,783 compared with 2,770 for previous week. . . .

PIPE LINES—Platte Pipe Line Co.'s big $60,000,000 crude line from Worland, Wyo., to Wood River, Ill., to go into operation the middle of next summer, company president reveals. . . . ¶Construction on segments of Phillips' products-line expansion progressing from Phillips, Tex., to East Chicago, Ind. . . .

Refiners' Dilemma

Million-barrel refinery-expansion program lagging, N.P.A. members told; lack of materials blamed for slowdown

George Weber

ATLANTIC CITY.—Refiners attending the forty-ninth annual meeting of the National Petroleum Association here learned the hard facts of life in an economy of current materials shortage.

On the one hand they were told that the program calling for 1,000,000 bbl. of crude capacity expansion, with all its attendant construction for supporting processes, will likely take at least 3 years instead of the scheduled 2. On the other, the million-barrel program, even if met in time, was stated as insufficient for what military authorities believe is urgently needed for national defense.

The crux of the problem is not the industry's lack of cooperation; it is the allocation of needed materials to carry out the program which has already been projected by refiners. C. E. Davis, director of refining for Petroleum Administration for Defense, revealed that 270 applications from refiners for certificates of necessity permitting accelerated amortization on new essential facilities had been received by PAD. These proposals from industry total 1,400,000 bbl. per day in basic capacity and would cost an estimated $1,200,000,000. The first 200 applications covering over a million barrels of capacity have been processed by PAD which has made recommendations for approval to the National Production Authority.

Since the May 1 announcement that no further applications would be accepted, it became apparent that not all projects covered by early applications would be built and it has been possible to recommend a number of additional applications, said Davis. So far, these have been confined to those proposals that also include new alkylation plants and other facilities for the manufacture of aviation gasoline in which category the capacity is still short of estimated defense requirements.

Present total.—The present total of all refining projects recommended amount to about 1 billion dollars, continued Davis, and provide for expansion in processing capacity after the estimated adjustment for probable cancellations as follows:

Charging capacity, in barrels per day: Crude distillation, 1,013,000; catalytic cracking, 750,000; catalytic reforming, 190,000; catalytic polymerization, 13,000.

Productive capacity, in barrels per day: Aviation alkylate, 50,000; benzene, 8,000, and toluene and aromatic aviation base stocks, 20,000.

Davis supported the statements by the military by pointing out that the program outlined above is considered the minimum and that studies under way will probably indicate that considerable additional capacity will be needed if the estimated requirements for products are to be satisfied.

Caught in freeze.—Of the applications passed on to NPA with PAD recommendation for approval, about 75 refining and chemical projects were caught in the "freeze" of August 13 which suspended DPA approvals for a 60-day period. Some of these involving alkylation facilities are being handled meantime, but the balance will presumably be held in abeyance until October, at which time they will be handled by DPA according to the new "ground rules" now being developed on the basis of the provisions contained in the order invoking the suspension.

At the request of PAD, the National Petroleum Council made a study of the expansion program, which showed that the industry plans to build new refining capacity over the next 2 years at an annual rate exceeding 500,000 bbl. per day.

The report further stated, said Davis, that the industry could increase crude intake by an additional 350,000 bbl. per day by removal of bottlenecks in existing facilities. He reiterated, however, that the projection of this expansion program for 1,000,000 bbl. of new capacity can be reached only if controlled materials in necessary amounts are allocated to the petroleum industry not only for necessary refining expansion but for transportation facilities as well.

Thus far, Davis concluded, allocations have been considerably below indicated needs, and on the basis of allotments for the third and fourth quarters, it is estimated that the 1,000,000-bbl. program cannot be completed in 3 years. The key to accelerating the plan is provision of sufficient controlled materials.

Lube expansion.—A recent PAD survey of lubricant capacity in this country indicates a shortage of high-viscosity-index lube production, the director of refining said. Their studies indicate that facilities should be increased by 15,000 bbl. per day and applications for accelerated amortization covering 6,000 bbl. per day are already in PAD hands. The survey revealed additional shortages of detergent-type lube-oil additives. A major proportion of this indicated deficiency of 15,000,000 lb. per month is also covered by similar applications from industry.

TEL and Abadan.—Compounding the vast problem facing PAD in securing for the industry the needed materials to carry out expansion commitments are two new crises. The recent decision indicating a drastic reduction of lead to TEL manufacturers would make it necessary to reduce the volume of TEL available for motor gasoline by 47 per cent, Davis said. This would result in an estimated octane drop of three full numbers, and PAD is exerting every effort to avoid the severe effects of such a consequence.

Of the total deficit of 600,000 bbl. per day caused by the shutdown in Iran, approximately 140,000 bbl. have been obtained for refineries in Europe from increased production outside the United States. The remaining deficit of 460,000 bbl. per day must be supplied by the United States if free Europe and other countries in the Eastern Hemisphere are to have oil. This can be met by diverting United States and Canadian imports elsewhere, and by exports from the United States. Imports that may be diverted from North America have been set at 190,000 bbl. for September through December. The remaining 270,000 represents gasoline, kerosine, distillate, and residual fuel which can be supplied if United States crude production can be increased to 6,300,000 bbl. per day and refinery runs increased to 6,650,000 bbl. per day, and crude-oil inventories reduced from 252,000,000 to 240,000,000 bbl. plus a reduction in product inventories of about 8,000,000 bbl. The foregoing will meet the deficit through November. In December and through the first quarter of 1952 it will only be possible to supply from the United States approximately 100,000 bbl. per day of crude oil.

Military wants more.—If the industry were able to build the 1,000,000-bbl. expansion program at once the situation would not be so bad, Rear Adm. B. B. Biggs, executive secretary of the Munitions Board petroleum committee, Department of Defense, said. Since it cannot be done at once, the rising demand curve tells us that it is not enough, he said, adding the now-familiar exhortation to "build as much as we can as soon as we can."

On the question of balance between high-octane avgas and jet-fuel capacity, he reminded refiners that the Navy and Air Force don't believe the former will be rendered obsolete for 5 years and even then alkylation

AT N.P.A. MEETING.—Shown during the Forty-ninth National Petroleum Association meeting in Atlantic City are, left to right: Fayette B. Dow, general counsel, N.P.A.; Gustav Egloff, director of research, Universal Oil Products Co.; U. S. Sen. Edward Martin of Pennsylvania; C. E. Davis, director of refining, PAD; and W. S. Zehrung, president, Pennzoil Co., Oil City, Pa., retiring N.P.A. president.

units will retain considerable economic value. The present lack of specific knowledge as to relative military needs for the two fuels named, plus residual fractions for Navy Special and ships' bunkers require that the industry also add units to existing facilities to increase the range of products that can be produced.

"We know that refinery yields can be varied within certain limits but I doubt that the limits are wide enough at present to take the shock of an all-out emergency," Biggs concluded.

Materials session.—The PAD contingent present at the meeting included, in addition to Davis, a group concerned with materials allocation which conducted a panel discussion designed to aid refiners in their efforts to obtain necessary allocations. This forum, including a question-and-answer period, served to clear up many points on proper procedure in making applications and reports which should serve to expedite future materials allocations.

For its efforts past and present, the PAD was repeatedly accorded expressions of confidence and appreciation by refiners during the 2-day meeting.

Dr. Gustav Egloff, director of research for Universal Oil Products Co., Chicago, delivered a paper on "European Refining and Middle East Oils." This comprehensive report will be carried in next week's issue of The Oil and Gas Journal.

Big Future Ahead

Tremendous growth in petrochemical field during next 10 years forecast by Texaco chemists at N.P.A. meeting

ATLANTIC CITY.—How big is the petrochemical industry? How big is it likely to become?

Answers to these timely questions were forthcoming in papers presented at a special session of the National Petroleum Association convening here for its forty-ninth annual meeting.

In an exhaustive study of ethylene petrochemicals, held last week, Dr. W. E. Kuhn, manager of the technical and research division of The Texas Co., and J. W. Hutcheson, research chemist at that company's Beacon Laboratories, presented a thorough estimation of the burgeoning industry in terms of its principal building block.

Referring to petrochemicals generally, the authors drew comparisons of past growth. In 1940, with a capital investment of $350,000,000, the industry produced on the order of 4,100,000,000 lb. of products. Five years later, investment has reached $1,200,000,000 and production 10,500,000,000 lb. Today the total investment is about $1,950,000,000 and output has advanced accordingly to a rate of 16,000,000,000 lb. per year. Ten years hence, they visualize a fourfold increase in both plant investment and volume output. Presently representing about 25 per cent of all domestic chemical production, petrochemicals will account for close to half the total chemical output in this country by 1962, they predict.

Returning to ethylene, the authors, by analyzing one by one the multiple end uses of the seven major ethylene-derived chemicals, traced the history of that important branch of petrochemicals and projected future trends to 1962.

Conclusions reached.—Here are some of their conclusions:

Using a census-vehicle yardstick, a total antifreeze market of 100,000,000 gal. appears reasonable in 1962, of which 55,000,000 gal. would be of the ethylene glycol type.

Direct use as antifreeze plus secondary uses in the synthesis of fibers, cellophane and papers, explosives, hydraulic fluids, industrial coolants, ethers, and resins, are estimated to amount to a total 1962 demand for 797,000,000 lb. of ethylene glycol as compared with 1950's demand for 510,500,000 lb. of the product.

A 383,000,000-lb. acrylonitrile demand for 1962 is estimated on the basis of synthetic fiber, plastics, and miscellaneous uses. It is believed probable that ethylene oxide will continue to be used for acrylonitrile production but after 5 years any increased demands for acrylonitrile may well be met by the use of acetylene as the raw material. Approximately 192,000,000 lb. of the total 383,000,000 lb. of acrylonitrile estimated for 1962 will come from ethylene oxide. This fraction will account for a 767 per cent increase over present demand.

Other ethylene oxide derivatives including ethanolamines, polyglycols, and glycol ethers and nonionic detergents will show 10-year demand increases ranging from 130 to 316 per cent.

Of the projected demand for 431 million gallons of ethyl alcohol for 1962, the authors estimate that 230 million gallons will be synthesized from ethylene.

Synthetic rubber.—Synthetic rubber and polystyrene demands by 1962 are estimated to reach a level requiring 1,235,000,000 lb. of styrene, in turn requiring about 400,000,000 lb. of ethylene per year.

Polyethylene, it is believed by many, will soon become the most important plastic, volumewise. This versatile plastic will probably prove to be the most rapid-growing chemical based on ethylene as a raw material. A 1,000 per cent expansion to a 1962 production of 550,000,000 lb. is estimated.

Kuhn and Hutcheson summarized their projections of ethylene-derived chemical requirements over the next 10 years in the accompanying table.

This estimated increase in ethylene requirements in the next decade is believed to be conservative. It does not in most cases reflect the rapid growth of the past 10 years. The authors have taken due consideration of the probability that acetylene will supplant ethylene for some purposes. On the other hand, they point to the possibility and probability that many potential ethylene-based chemicals now either in the research or pilot-plant stages may loom important 10 years hence.

"Ethylene-derived chemicals certainly have not reached a peak production but are still in a field that

PROJECTED CHEMICAL REQUIREMENTS FOR NEXT 10 YEARS

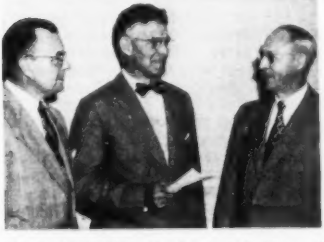
Commodity	1950 (million lb.) Commodity prod.	1950 (million lb.) Ethylene requirements	1962 (million lb.) Commodity prod.	1962 (million lb.) Ethylene requirements	Per cent increase
Ethylene oxide	483	483	1,116	1,116	231
Ethyl alcohol (synthetic)	103.9	495	230	1,110	224
Ethyl benzene	539	173	1,235	400	231
Ethyl chloride	350	137	...	350	255
Ethylene dichloride		90	....	200	222
Ethylene dibromide		30	...	50	167
Polyethylene	55	55	550	550	1,000
Other		73	...	170	233
Total		1,536		3,946	257

is increasing substantially and continuously," they conclude.

Other basics.—Propylene, which accounted for 3,000,000,000 of the 16,000,000,000 lb. of petroleum fractions which went into 1950 petrochemical synthesis, was discussed by V. C. Irvine, manager of Shell Chemical Co.'s products-development department. Irvine discussed the various synthesis routes followed by manufacturers in producing the many propylene-derived petrochemicals today.

H. E. Bramston-Cook, vice president of Oronite Chemical Co., discussing aromatics, pointed to the petroleum industry as the prime source of aromatics in the near future. It appears that the traditional sources of supply of byproducts from metallurgical coke production have now reached their limit in almost all instances whereas the dynamic growth of the consuming industries, notably plastics, will continue and the additional requirements will be supplied by the petroleum industry. In the long range future, he foresaw that coal will again assume an important part in aromatics supply via synthetic-fuel production.

Dr. Carl W. Kelley, of the Office of Petroleum Programs, Munitions Board, outlined many of the fuel and lubricant problems facing the military, and pointed to numerous petrochemical developments which indicate solutions to some of the current military needs.



N.P.A. OFFICERS.—Newly elected officers of National Petroleum Association are, left to right: Fred G. Bannerot, Jr., executive vice president, Elk Refining Co., Charleston, W. Va., second vice president; Earle M. Craig, president, Freedom-Valvoline Oil Co., Freedom, Pa., president; and A. W. Scott, president, Wolf's Head Oil Refining Co., Inc., Oil City, Pa., first vice president. G. B. Hunter, vice president, Quaker State Oil Refining Corp., Oil City, was reelected treasurer.

Deep Rock Sells Outlets

Deep Rock Oil Corp.'s 2-year program of withdrawing from all direct marketing operations in favor of the independent local business man has been completed, W. H. Garbade, president, announced in Tulsa this week.

B. L. MAJEWSKI

Its last marketing properties—those in the Chicago area—were sold to Great American Oil Co., a Deep Rock distributor headed by B. L. (Barney) Majewski.

Majewski will remain on Deep Rock's board of directors. He is an outstanding spokesman for the independent's viewpoint in the oil industry, and since 1933 has been a director and member of the executive committee of American Petroleum Institute.

Other officers in Great American are Leslie P. Craig, Edward J. Maguire, Henry G. Wiemhoff, all of Chicago and former Deep Rock employes; and Benjamin S. Adamowski, Chicago attorney.

Gas Panel Scheduled

Compact sets underground storage study December 11

FORT WORTH.—A panel discussion on underground storage of natural gas will be the primary feature of the winter meeting of the Interstate Oil Compact Commission to be held in Little Rock, Ark., December 11 and 12.

This discussion originally was scheduled by the engineering committee for the Fort Worth meeting September 11 but was postponed in order to enlarge its scope. The December panel will be arranged jointly by the engineering and legal committees and will cover both engineering and legal problems in setting up and operating underground gas-storage reservoirs.

The growing interest in gas utilization is further reflected in the engineering committee's agenda of projects for discussion at future meetings, which includes the economics of gathering gas from oil fields and criteria for the conservation of marginal gas, a basis for establishing field-wide or market-demand allowables for gas wells, and practical standards for uniform gas measurement.

Dual-completion study.—The research and coordinating committee, having made a final report on well spacing which recommends wide spacing as a conservation measure *(The Oil and Gas Journal, September 13, page 77)*, is now engaged in a study of dual completions as a means of saving steel, and is expected to have a report at the December meeting.

The commission voted to continue its secondary-recovery division, which was established 3 years ago on a temporary basis, and to combine its committees on secondary recovery and stripper wells.

The next meeting of the commission probably will be held in Phoenix, Ariz., early in April, and the summer meeting in Banff, Canada, August 31 to September 2, 1952.

Outlook Good

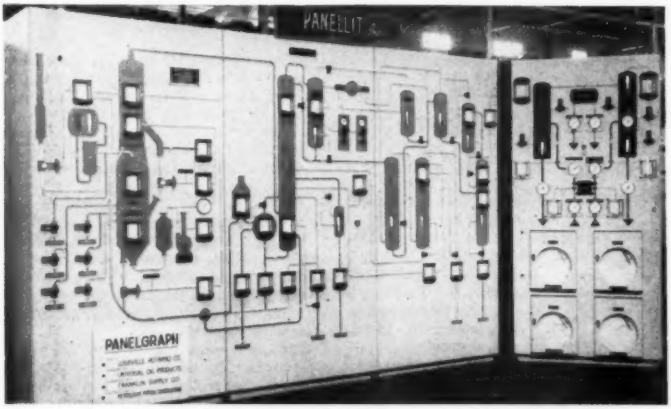
Survey of oil companies shows many rising trends

NEW YORK.—Data on 30 oil companies comprising about two-thirds of the petroleum industry in the United States show increases in demand, production, income, and dividends during the first 6 months of 1951 as compared with the corresponding period of 1950, according to the midyear financial survey prepared by the petroleum department of Chase National Bank.

Crude production of the entire United States industry increased 20.2 per cent, while demand for all products increased 12.8 per cent during the first half period. Though crude prices were firm, domestic prices for refined products were 12.4 per cent higher than for the same period of the previous year.

Outlay up.—The combined outlay for property, plant, and equipment should be substantially more during 1951 than the $1,894,000,000 spent by the 30 companies last year, the survey said. This belief is based on estimates supplied by several companies. With earnings substantially in excess of dividends, only a few companies are expected to require funds from outside sources for financing capital expenditures in 1951.

If present conditions hold for the remainder of the year, it is estimated that gross operating income for the 30 companies may reach an all-time high of $18,000,000,000 compared with $15,300,000,000 for 1950. Net income of the group of companies amounted to $999,000,000 for the first 6 months of 1951, an increase of 41.5 per cent over the first half of 1950.



I.S.A. EXHIBIT.—From exhibit floor to refinery control room go these two panels, made by Panellit, Inc., Chicago. The three sections on the left are destined for Louisville Refining Co.'s plant. The panel section on the right is to go to Sun Oil Co.'s Marcus Hook, Pa., refinery. Panels were part of an exhibit shown at Sixth National Conference and exhibit held in Houston last week.

Instruments' Role Cited

They play important part in discovery of oil and gas, and their use is rapidly increasing, I.S.A. reveals

F. Lawrence Resen

HOUSTON.—The important part instruments play in the discovery of oil and gas, in production, and in processing, and their rapidly increasing use in all phases of the petroleum industry was the principal theme of the Sixth National Instrument Conference and Exhibit held here this week.

More than 75 technical papers and 230 exhibits made up the program, which was sponsored by the Instrument Society of America, along with 10 participating organizations.

Manufacturers' display booths held the newest and latest devices for measurement and control purposes. Geophysical equipment, gas-lift timers, automatic lease controls, automatic loading-rack controls, pressure regulators, and remote tank-gaging instruments were on exhibit. New-type valves for use in pipe lines and in process flow lines were presented, as were temperature-control units, new laboratory equipment, the latest in flow meters, and graphic panels. Two panel sections, by Panellit, Inc., Chicago, were destined for transportation to Louisville Refining Co.'s plant and Sun Oil Co.'s Marcus Hook, Pa., refinery where they will be incorporated in control rooms.

Technical papers.—The technical program consisted of the presentation of 78 papers devoted to instrumentation, plus a number of panel discussions on technical subjects. K. E. Hallikainen and D. J. Pompeo, Shell Development Co., Emeryville, Calif., presented a paper on "Continuous Recording Electrometric Titrometer," which stressed its use in gasoline-refining operations. A completely automatic on-stream instrument was developed to determine the mercaptan sulfur content of a doctor-treated gasoline.

The device consists of two pumps, one of which pumps the liquid to be titrated at a constant rate and the other which is used for pumping titration liquid at a rate to keep the combined solution at an equivalence value. The rate of pumping the titration liquid determines the per cent of mercaptan present. The instrument has been an aid to operators in detecting plant upsets and thereby minimizing their effects.

Pneumatic trend attacked.—An apparent trend among some control engineers who are discarding hydraulic governors in favor of completely pneumatic systems was viewed with disfavor in a paper presented by J. A. Pellettere, Gulf Oil Corp. In discussing turbine governors and their relation to pneumatic controls, he promotes the theory of cascaded controls for good governor design. Such instruments as the speed control (fly-ball) should not be retired to pre-emergency work, but should be kept in continuous service by cascading the primary instrument with the speed controller, he said.

The extensive use of thermocouples in laboratories and in plant processes has brought forth a need for readily usable information which would point out the correct procedure for checking and calibrating types of thermocouples. Henry C. Quigley, E. I. du Pont de Nemours & Co., Inc., presented a resume of the checking procedures to be used with the common types of thermocouples.

Alcohol output up.—The production of alcohol by oil companies is on the increase as witnessed by Shell Chemical Co.'s installations at Houston and Gulf Oil Corp.'s new facilities being constructed at Port Arthur. I. Lefkowitz described the completely automatic system used in alcohol-distillation procedures by Joseph E. Seagram & Sons, Inc., Louisville, Ky. The control problems met in the distillation of alcohol are very similar to those found in refining processes. The controls necessary, however, are somewhat more critical than those found in the processing of crude oil into end products such as gasoline and fuel oil.

"Operation of a Semicontinuous Process Using the Kinegraphic Control Board," by John E. Read and John Johnston, Jr., du Pont engineers, points out the use of a kinegraphic control board and its intelligent operation in controlling complicated process flows. The use of automatic controls insure continuity of operational steps and prevents shutdowns due to misjudgments on an operator's part. The authors suggest the adaptation of pneumatic energy for those elements which require power for dependable operation and the use of electrical energy for signaling purposes. Their feeling is that such an arrangement represents the combination where the attributes of both energies may be best applied.

Well-logging methods.—A description of well logging and the methods used in making several of the measurements down the hole and the transmission of this information was described in "Telemetering In Well Logging," by Walton J. Greer, Halliburton Oil Well Cementing Co. Greer described the problems which have to be surmounted in logging and presented a detailed description of electrical logging as well as short studies of caliper and collar logging methods.

The Instrument Society of America is the newest of the major technical societies. It was organized in 1945 by 18 groups of instrument technicians scattered across the nation. Since 1945 the society has grown to

51 local sections with a membership of approximately 5,000. The newly elected president is A. O. Beckman, president of Beckman Instruments, Inc., South Pasadena, Calif. Newly elected vice presidents are Dave Boyd, Universal Oil Products Co., Chicago; and Robert T. Sheen, president of Chemical Pump & Equipment Corp., New York.

Controls Symposium

Texas A. & M. sponsors sixth of instrument series

HOUSTON.—Seven papers dealing with various controls for the petroleum industry were presented at the Texas A. & M. College annual symposium on Instrumentation for the Process Industries, held here last week in conjunction with the Sixth National Instrument Conference and Exhibit.

A review of refinery-control problems prepared by Cities Service Refining Co.'s engineers and presented by E. D. Mattix gave in capsule form the manner in which the engineers solved several operational problems at the Lake Charles refinery. Such diversified subjects as pH control of crude units, priming facilities for crude unloading of barges, and surging of sidestream level controllers on crude-topping and cat cracking units were covered in the composite paper.

Donald P. Eckman, Case Institute of Technology, presented a paper dealing with pneumatic operators for throttling controls. He reviewed the proper design necessary in building a pneumatic operator for proportional position control. In the paper he brought forth relative merits of spring - diaphragm pneumatic operators, springless motors, and rotary pneumatic motors.

Synthetic rubber. — The processes in the manufacture of synthetic rubber parallel those found in refining methods in many instances. J. S. Detwiler, Taylor Instrument Co., Rochester, N. Y., made a study of the development of the instruments in use in the synthetic-rubber industry and how they were modified to meet changing conditions. Temperature control is one of the prime factors in the processes of synthetic rubber and the thermal systems are highly developed to permit for accurate transmission in the installations covered by Detwiler.

Farrar directs.—Prof. G. L. Farrar, of Texas A. & M. College, was director of the symposium. Technical chairmen were R. E. O'Neill, L. W. Parten, and C. F. Woods. The symposium is the sixth of a series inaugurated by Texas A. & M. in 1946.

Harrop Lauds Instruments

HOUSTON.—Today's mass-production methods used in oil refineries and petrochemical plants have been made possible by instruments providing for automatic control and measurement, James Harrop, general superintendent of Humble Oil & Refining Co.'s Baytown plants, stated here.

Speaking before a luncheon meeting given by the Scientific Apparatus Makers Association during the Sixth Annual Conference of the Instrument Society of America, Harrop predicted that eventually instruments will transmit information from plant processes directly to accounting machines.

The operation of a hydroforming unit requires 35 motor - operated valves and numerous accurate temperature and pressure controls, Harrop said. It would be almost impossible to staff the unit with enough men to open, close, and regulate the valves at the exact times necessary, he said. Present controls are regulated by instruments hundreds of feet from the operation itself. with the use of instruments, fractionation towers are carefully controlled within a quarter of degree of temperature on some plates. A variation of this temperature beyond these narrow limits would mean a product quality loss of $800 per day, he said.

Harrop stated that at Baytown the instrument department has actually been able to handle an increased production from 185,000 bbl. per day in 1945 to better than 250,000 bbl. per day in 1951, with a decrease in instrument personnel from 170 to 135 through use of new-type instruments.

New Reforming Catalyst

Low coke deposition, good yield-octane relationship, economic aromatics production promised in T.C.R. process

George Weber

NEW YORK.—A report on results of laboratory and pilot-plant studies of a coprecipitated catalyst composed of chromia and alumina reveals that this catalyst will be the one to be used in the recently announced Thermofor Catalytic Reforming process.

In a paper presented before the Fuel, Gas and Petroleum Chemistry Section at the twelfth International Congress of Pure and Applied Chemistry, seven authors associated with Standard Oil Co. (Ohio) and Socony-Vacuum Oil Co., Inc., reported new findings on use of this catalyst. The current paper, by E. C. Hughes, H. M. Stine, and H. A. Strecker, of Sohio; and S. C. Easterwood, C. L. Gutzeit, W. A. Stover, and S. J. Wantuck, of Socony-Vacuum, is restricted to performance of the catalyst. A subsequent paper to be presented next spring by Socony-Vacuum will detail the process.

The T.C.R. process, as revealed previously by Socony-Vacuum, will resemble the modern T.C.C. process also licensed by that company, in providing a moving catalyst bed in the reactor with continuous catalyst regeneration in a separate regenerator or kiln. In this respect it will differ from other reforming processes which comprise fixed-bed or fluidized-bed systems. Like them it will suppress coke deposition by hydrogen recycle to the reaction zone, and will combine isomerization, dehydrogenation and cyclization to produce high-octane, aromatic - rich reformate to meet current and future requirements for upgrading virgin and thermally cracked naphtha fractions.

Catalyst development. — While chromium and molybdenum oxides have been long recognized as catalysts for naphtha reforming, molybdenum oxide supported on alumina became the first catalyst to gain commercial use in the hydroforming process. Continued research by Standard of Ohio on the chromia type led to the discovery that a coprecipitated catalyst containing 20 mole per cent cromia and 80 mole per cent alumina showed naphtha-reforming results said to be fully as good as those obtained with the molybdena catalyst.

These investigations, combined with similar studies conducted by Socony-Vacuum, led to the development by the latter company of a new bead form of chromia - alumina catalyst which will be used in the T.C.R. process. The new strong bead is harder than silica-alumina, used in catalytic cracking. One of its outstanding characteristics as a reforming catalyst lies in the fact that it enables coke deposition to be controlled to a low level by a lower partial pressure of hydrogen than any other catalyst, the authors said.

Numerous charge stocks. — Investigators reformed many straight-run and coker naphthas over a wide range of operating conditions. In this work they noted some substantial differences between naphthas from various sources. Their data show a close correlation with the Watson-Nelson characterization factor, and the authors suggest that as a first approximation, the "K" factor should be very useful in selecting suitable feed stocks for reforming with the chromia-alumina catalyst.

It was found that within the temperature range of 950 to 1,025° F. and space velocity of 0.5 to 2.5, essentially the same product distribution was obtained by any combination of the two operating variables which gave equiv-

alent octane number. Varying recycle gas to naphtha mole ratios up to above 10 to 1 revealed that increased ratios increased liquid yield and decreased coke formation when reforming to a given octane level.

Most runs were conducted with a coke buildup on spent catalyst of less than 3 per cent by weight. Under these circumstances, changes in catalyst to naphtha ratio had little effect on yield or product quality. Studies of pressures up to several hundred psig. were conducted with the findings that with other variables held constant, increasing the pressure improved reformate octane number, liquid yield increased and passed through a maximum, and hydrogen production, coke production, and sulfur content in the reformate steadily decreased.

Yield-octane relationship.—The yield-octane relationship was reported on virgin naphthas from Texas, California, Illinois, Mid-Continent, South American, and Middle East crudes and on blends of virgin and coker naphthas from California and Illinois crudes. Most were heavy naphthas with F-1 clear octane ratings from 33 to 64 and sulfur contents from 0.02 to 0.56 weight per cent. They were reformed at 100 psig. total pressure, 1.0 V/Hr/V space velocity and recycle gas to naphtha mole ratios of 6/1. Reforming temperatures were adjusted to obtain products of 90, 94 and 98 F-1 + 3 cc. TEL octane levels. C_5 + reformate yields at the 98 F-1 leaded octane level ranged from 85.8 per cent for Tibu-Petrolea to 89.3 for West Texas virgin naphthas. The 60-40 per cent blend of California virgin and coker naphthas showed a corresponding yield of 86.5 per cent. At the 90 F-1 leaded octane level the corresponding yields ranged from 91.7 per cent to 95.7 per cent. The 10-lb. RVP reformate yields exceeded 100 per cent in six of the eight reported naphthas at the 90-octane level and in five at the 94-octane level, due to the blending of outside n-butane required to bring C_5 + reformate up to 10 lb. RVP.

Aromatic yields.—At 100 psig. reactor pressure, light medium naphthas (150°-250° F.) yield up to 10 per cent benzene, 20 per cent toluene, and 8 per cent C_8 aromatics. Prefractionation of naphtha feeds for selective aromatics production give higher yields; for example a 7° F. boiling range naphtha was prepared which yielded 54 volume per cent benzene based on charge.

The aromatization promoted by the catalyst also makes it suitable for production of aviation blending stock. For example, a 208-281° F. West Texas naphtha yielded 44.7 per cent of aviation-base stock with calculated blending values of 96 F-3 and 173 F-4 with 4.6 cc. TEL.

Desulfurization.—The new catalyst shows excellent desulfurization characteristics. At reforming pressures of 100-175 psig. sulfur reduction ranges from 86 to 97 per cent for various naphthas.

The first commercial application of this catalyst in a Thermofor Catalytic Reforming unit will be the 3,000-bbl. per day unit which Socony-Vacuum will build at the Augusta, Kans., refinery.

SOUTHWEST

Production Tests Ordered

Pressure drop in parts of Canyon reef fields prompts commission action in Diamond M, Kelly-Snyder fields

Henry D. Ralph

AUSTIN.—Declining pressure in parts of the Canyon reef fields of Scurry County has prompted the Texas Railroad Commission to order production tests in the Diamond M and Kelly-Snyder areas.

The order was issued following a hearing September 12 at which operators reported on the condition of the reef fields. These showed that in Diamond M and Kelly-Snyder the pressure has dropped to or below the saturation or bubble point. The commission ordered the production tests taken before October 20 in order to expedite a pool pressure-regulation system to prevent loss of reservoir energy.

At the hearing most operators minimized the importance of the decline in pressure, saying that the field is performing as expected and that waste is being eliminated. The operation of several natural-gasoline plants and plans for pressure maintenance should bring an early end to waste, they testified.

Operators asked retention of the present allowable of 100 bbl. per day per well, except that Magnolia Petroleum Co. recommended that the allowable be cut to 65 bbl.

Part of study.—The hearing was part of a continuing study of producing methods in the Canyon reef which started last December when the commission cut allowables from 160 bbl. per well and expressed concern at the drop in bottom-hole pressures.

In Kent County, a gasoline plant will be in operation very shortly and will completely eliminate flaring in Cogdell field, the operators testified, and in Salt Creek field the pressure was reported above the bubble point. Between 2 and 3 million cubic feet of gas is being flared daily in Salt Creek field at present, but Hunt Oil Co. and General Crude Oil Co. have underwritten a gas-injection program to return this gas to the reservoir.

Kelly-Snyder.—In Kelly-Snyder, the evidence showed, the bottom-hole pressure has dropped to 2,002 psi. from the original pressure of 3,112 psi. in November 1948. The problem of casing-head gas in Kelly-Snyder is completely solved by the operation of two natural-gasoline plants, it was testified, and both plants could be expanded easily, as the gathering systems have capacity for much more gas than is now handled.

Two pilot gas-injection projects are being conducted experimentally in Kelly-Snyder field. Standard Oil Co. of Texas on July 18 started injecting 1,200 to 1,900 cu. ft. per day at about 1,700 psi. Lone Star Producing Co. started on July 16 to inject 5,000 to 6,000 cu. ft. per day at 2,200 psi.

Diamond M.—In Diamond M field the average pressure has dropped below the saturation point, it was reported, but the production rate is expected to remain constant. About 75 per cent of all the wells are connected to a gasoline plant and the rest will be connected by December 1. A water-injection pilot project has been in operation in Diamond M since November 1950, and is now injecting about 1,600 bbl. per day at 1,500 psi.

Sharon Ridge.—In Sharon Ridge field about 6,000,000 cu. ft. of gas is being flared daily, but the wells are being connected to a gasoline plant scheduled to begin operating late in October.

Unit plans described.—Two voluntary unitization plans were described to the commission.

E. L. Allen, of Lion Oil Co., said that a plan for Diamond M field is already on file with the commission, and all equipment can be obtained during the first quarter of 1952 if approval is received soon. While the operating plan has not yet been decided, equipment is contemplated to inject either water or gas, or both.

A larger unitization plan, embracing most of Diamond M, Kelly-Snyder, and Sharon Ridge fields, was outlined by W. L. Horner, of Sunray Oil Corp., representing the Scurry Area Canyon Reef Operators Committee. He said the operators in this group are spending more than $70,000 preparing the plan and expect to have a report completed in October. If the commission approves this plan, Horner said, it might lead to the adoption of new producing methods, since research along this line is making good progress.

Products May Run Short

Over-all shortage in U. S. possible before end of 1951; big inventories could create soft inland-area market

John C. Casper

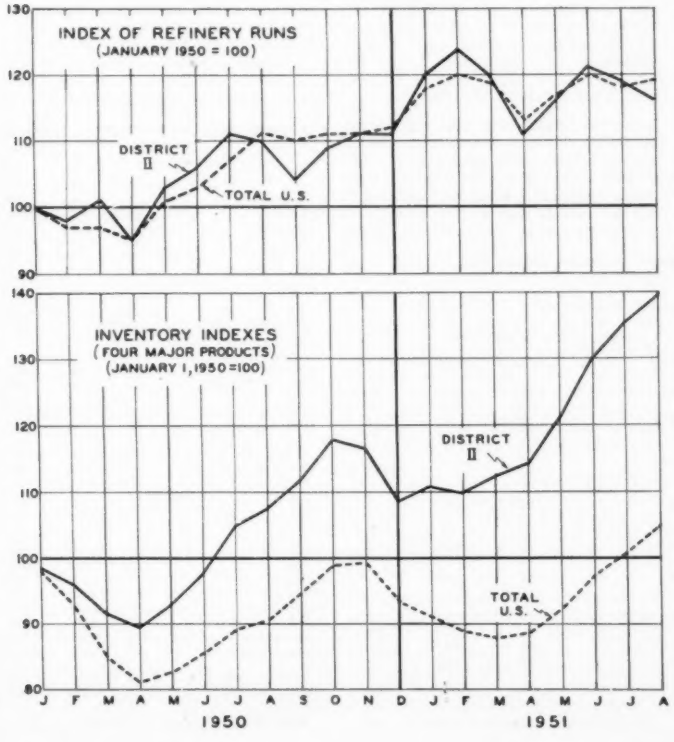
THIS country may have an over-all shortage of petroleum products before the end of the year and at the same time have soft product markets in inland areas because of high inventories.

Current estimates indicate that export shipments of petroleum products from Gulf Coast and East Coast ports in September may reach at least twice the volume moved in the same month last year. These extra products are going to consumers, mostly in Europe, normally supplied from the Abadan refinery. If this export rate is continued into the winter months, and if product imports, mostly residual fuel, are cut back because of heavy shipments to Europe from refineries in the Caribbean area, refiners in Districts 1 and 3 may not be able to meet expanded domestic demands.

At the same time, high product inventories in District 2 may tend to produce soft product markets in the area.

Total inventories of crude and four major products in United States at the end of August were 53,000,000 bbl. greater than at the same time last year. Of this total, major products accounted for 38,000,000 bbl., but almost 20,000,000 bbl. of this increase was in District 2. Stocks in the Rocky Mountain area were up about 500,000 bbl. while West Coast inventories were down 1,500,000 bbl. for a net gain of only about 19,000,000 bbl. for Districts 1 and 3 combined.

Asiatic Petroleum Co., buying in this country to cover British petroleum requirements, purchased about 7,500,000 bbl. for September liftings. Excess stocks accumulated in the past year on the Gulf Coast and East Coast would cover less than 3 months' gain in exports brought about by the Iranian shutdown.



Location big factor.—Location of product stocks in District 2 make them unavailable for export, and current ceiling prices on export sales discourage shipments from the fringe areas of District 2 to tidewater points. Some of the distillate fuel in East Texas will move by tank car to Gulf Coast ports rather than to northern markets in District 2, and the shortage of residual fuel on the Gulf Coast will attract heavy fuel from other inland Texas refineries, but in both cases the volume will be limited.

Some of the material which normally moves up the Mississippi River by barge will be exported or shipped to District 1, but again, price ceilings may prevent large-scale diversions.

In the accompanying chart comparisons of refinery runs and product inventories in District 2 and the United States are shown by index numbers with early 1950 taken as 100. The top lines indicate that refinery operations in District 2 followed about the same trend as that for the country as a whole. On the other hand, the bottom chart shows that increases in inventories of the four major products in District 2 have been out of proportion to the relative stock position of the district.

Summer demands less.—Some suppliers have admitted that summer demands have been slightly less than estimates made last spring. Indicated demand for the four major products produced at refineries in District 2 in the 4-month period from May through August were slightly less than 8 per cent greater than for the same period last year, compared with a gain of about 10 per cent for all districts combined.

Indicated refinery demand for gasoline in District 2 was up about 9 per cent for the 4-month period, compared with a national gain of almost 11 per cent.

Deliveries of District 2 kerosine in the May-August period were actually less than in the same months of 1950. The distillate gain was less than 4 per cent. If this drop in the movement of home-heating fuels was due to excessive inventories in reseller and consumer tanks at the end of last heating season, an early winter will be needed to help solve a possible storage problem in District 2.

No softening.—Higher - than - normal stocks did not produce any general softening of the Group 3 market during the summer months. Reports of under-the-market sales were scattered, and volumes involved were not large enough to affect the over-all market. The amount of distress material on the market will be the major factor in determining District 2 gasoline and heating-oil prices between now and the end of October.

Crude Shortage Looms

High-level U. S. output, withdrawals from stock to help offset Iranian loss only until December, Compact told

Henry D. Ralph

FORT WORTH.—Production and refining of petroleum in the United States must be kept at the highest possible levels this fall in order to make up the deficit in European supplies caused by the shutdown of the Abadan refinery in Iran, the Interstate Oil Compact Commission was told last week by Cecil L. Burrell, director of the program division of the Petroleum Administration for Defense.

Such a program, together with withdrawals from stocks in this country, will meet European needs until about December 1. After that, Burrell said, there will be a world shortage and it will be up to the President to decide whether the United States will let its own supplies run short to aid Europe.

Several state representatives demurred against using the small remaining producing capacity in order to help Britain in its controversy with Iran, and others suggested that an early settlement might leave this country with excessive stocks. Burrell discounted this and said that even if Abadan went back on stream tomorrow there would be a need for maximum output here through October at least, and that crude output should be kept at the limit of pipeline capacity.

The government policy, he said, is to supply Europe to the fullest extent possible without hurting the United States, and to this end PAD has worked out a program with British representatives and American oil companies operating abroad. He outlined this program as follows:

Iran crude replaced.—The 150,000 bbl. per day of crude formerly exported by Iran has been entirely replaced by crude from Saudia Arabia, Kuwait, and Qatar. There is 190,000 bbl. per day excess refining capacity in Europe which can be utilized by diversion of foreign crude intended for the United States and Canada, currently 130,000 bbl. per day and scheduled to be increased by 50,000 bbl. per day during October.

This program will meet the needs until about the end of November provided United States crude production continues at the September rate of about 6,300,000 bbl. per day, which is the maximum pipe-line capacity. During this period United States stocks of crude will be drawn down to about 240,000,000 bbl. and products stocks will be reduced by about 8,000,000 bbl.

Tight crude supply.—After December 1 the United States cannot spare more than 100,000 bbl. per day of crude for diversion and can do little in the way of products even with refineries running 6,650,000 bbl. daily. Europe and the United States will be long on gasoline and short on all other products, which means that European refineries should adjust their yields to get the maximum fuel oil, resulting in general degradation of all products.

The accompanying table, prepared by PAD, shows the program worked out to supply the 460,000 bbl. daily normally exported from Abadan. Burrell asked that production and refining be maintained at the maximum during this period before the heavy winter demand sets in and in order to defer stock withdrawals as long as possible.

SUPPLIES AVAILABLE TO MEET IRANIAN SHORTAGES
(Thousands of barrels daily)

	Products available		Products purchases outside U. S.	Total products		Long or (short)
	From U. S.	From diverted crude*		Available	Required	
September:						
Gasoline	126	52	2	180	107	73
Kerosine	23		1	24	47	(23)
Distillate	52	27	5	84	95	(11)
Residual	52	111	9	172	211	(39)
Total	253	190	17	460	460	
September-October:						
Gasoline	125	52	6	183	107	76
Kerosine	21		2	23	47	(24)
Distillate	51	27	4	82	95	(13)
Residual	52	111	9	172	211	(39)
Total	249	190	21	460	460	
September-November:						
Gasoline	115	52	7	174	107	67
Kerosine	22		2	24	47	(23)
Distillate	49	27	4	80	95	(15)
Residual	47	111	9	167	211	(44)
Total	233	190	22	445	460	(15)

*Assumes normal yields.

Imports Drop

July figures on imports down, but exports gain

IMPORTS of crude and products into the continental United States decreased for the month of July and exports increased, according to data released by the Department of Commerce.

Total imports averaged 800,000 bbl. daily compared with 865,000 bbl. daily in June and 761,000 bbl. daily in July 1950. The gain of 16,000 bbl. daily in crude imports was more than offset by the drop of 81,000 bbl. daily for products, mostly residual fuel. The sharp drop in receipts of residual was greater than would be expected from the normal downward trend for summer months and can be explained by the shortage in heavy fuel since the closing of the Abadan refinery.

Crude imports listed as other include 220,000 bbl. from Trinidad and 327,000 bbl. from British Borneo.

Exports high.—Crude and product exports, excluding shipments to territories, averaged 463,000 bbl. daily, the highest since 1947. This represented a gain of 24.4 per cent over June and 69.6 per cent over July of last year.

Crude exports declined slightly from June, but shipments of products increased under the influence of purchases for customers normally supplied from the Abadan refinery.

IMPORTS INTO CONTINENTAL UNITED STATES
(Thousands of barrels)

	July 1951	June 1951	July 1950
Crude—			
Mexico	1,210	794	757
Colombia	1,276	1,491	977
Venezuela	9,348	9,401	8,290
Kuwait	2,827	3,056	2,236
Saudi Arabia	2,404	1,578	1,214
Other	547	227	110
Total crude	17,612	16,547	13,584
Daily average	568	552	438
Products—			
Residual fuel	6,352	8,606	8,430
Other products	829	781	1,575
Total products	7,181	9,387	10,005
Daily average	232	313	323
Total all oils	24,793	25,934	23,589
Daily average	800	865	761

EXPORTS*
(Thousands of barrels)

	July 1951	June 1951	July 1950
Crude	2,320	2,342	3,275
Gasoline	3,476	2,512	1,442
Kerosine	591	387	43
Distillate fuel	2,257	1,144	990
Residual fuel	3,179	2,471	935
Lube oils	1,618	1,407	1,100
Other products	905	898	683
Total all oils	14,346	11,161	8,468
Daily average	463	372	273

*Excludes shipments to territories.

Squeeze Tightens

Scarcity of nickel may mean inferior rock bits; controls put on tubular-goods export; quebracho supply guarded

WASHINGTON. — The squeeze on metals and other materials vitally needed by the operating oil industry is steadily getting tighter.

Shortages of steel, lead for TEL, copper, quebracho, and other oil-industry musts have been felt increasingly since the defense program was initiated. Now nickel is added to the list.

Just recently the Petroleum Administration for Defense called on operators to conserve for maximum use sucker rods made of nickel steel in anticipation of a 30 per cent cut in availability of such rods. Last week it was revealed that the National Production Authority has ordered steel mills furnishing nickel steel to rock-bit manufacturers to slice by half the amount of nickel in this steel.

Steel mills which customarily furnish "4800 series" steel with about 3.5 per cent nickel will now supply modified-grade "4600 series" steel containing 1.75 per cent nickel.

The drastic cut in nickel content will be partially offset with an authorized increase of molybdenum in rock-bit steel. Even with more molybdenum, however, the change in steel specifications is expected to result in a reduction of the life of the average rock bit by 3 to 5 per cent, depending on type of formation, weight on bit, and rotating speed.

Tests forthcoming.—Bit manufacturers have advised PAD that they will make extensive tests of the new nickel steel as soon as it is received next month in an effort to develop cutters giving as nearly as possible the same service as those now in use.

Whether cut in nickel content will eventually involve increased consumption of steel for rock bits has not been determined by PAD. Agency officials pointed out, however, that any large reduction in quality would increase the number of round trips required for changing bits in drilling a given amount of hole and thus impede the over-all oil and gas-production program. If manufacturers cannot produce a bit of like or nearly as good quality with the new steel, the inferior bit would mean a proportionate increase in total amount of steel to drill the same footage.

Steel help.—Any chance that considerable supplies of steel designated for oil use might be turned instead to the building of a $445,000,000 synthetic-liquid-fuels project appeared headed down the drain last week.

Defense Mobilization Director Charles E. Wilson said he would not approve allocation of steel required for a proposed coal-hydrogenation project in Illinois or a shale-oil plant in Colorado.

Wilson said that the two plants, which have been pushed vigorously by Interior Secretary Oscar Chapman, would require between 200,000 and 300,000 tons of steel to build. He declared that these processes are not yet sufficiently developed to warrant such a huge investment in metals.

Chapman had already run up against considerable opposition to embarkation on a large-scale synthetic-fuels program in Congress due to such a program's heavy cost in money and steel.

Tubular-goods exports.—Meanwhile, exports of scarce oil-country tubular goods and line pipe, both seamless and welded, were placed under strict controls by the Office of International Trade last week.

Under NPA Order M-46A, applications for priority ratings and export licenses must be filed with OIT by operators seeking materials for operations in foreign countries other than Canada.

One of two procedures must be used. An operator seeking materials for a construction program costing in excess of $10,000 need file only a single application on PAD-26A along with an export-license application on Form IT-419. For other materials quarterly applications must be filed on IT-824.

For the first quarter of 1952, applications must show requirements for casing, tubing, and drill pipe by size and grade. In succeeding quarters this information must be accompanied by data on the nature and extent of the operations for which the material is needed, the quantity of tubular goods in transit and in inventory, and the quantity used in the preceding quarter.

Operators must notify OIT after placing rated orders for oil-country tubular goods. Orders not placed and accepted for delivery after priority assistance has been granted must also be reported.

Quebracho move.—An effort to insure that a large share of the meager supplies of quebracho available are channeled to the oil industry also was made by NPA last week. NPA prohibited quebracho use for other than oil and gas production and a few other defense-essential activities.

The limitation upon use of quebracho in drilling is continued at 60 per cent of its use during the first half of 1950. This is spelled out in an amendment to NPA Order M-57, in which the calculation of use is changed from terms of weight as provided in the original order to "tan units," the measure commonly used in the leather trade.

Gasoline-Ration Plan

New program effective should all-out war come

WASHINGTON.—A comprehensive plan for the rationing of civilian gasoline is being worked out by the Petroleum Administration for Defense, for application if and when the United States should become involved in an all-out war.

The rationing program is one of a number which the defense agencies are preparing under instructions from Economic Stabilization Administrator Eric Johnston. The basic idea is to have all arrangements made in advance of a war to put the national economy on an austerity basis without delay.

Theoretically, it is figured that civilian gasoline consumption could be cut by 20 per cent. Practically, most experts figure that a 10 per cent cut would be the best that could be achieved in a country where labor is so dependent upon automotive transportation to get to and from industrial plants and public transportation facilities would be unable to take over that job. Estimates of the gasoline savings made through rationing during the last war range between 10 and 14 per cent, and the actual saving was probably close to the lower figure.

The idea behind Johnston's call for

Deadline September 30

WASHINGTON. — Bruce K. Brown, deputy petroleum administrator, has reported that deadline for applications for tubular goods to be delivered during the first quarter of 1952 is September 30. Operators must file on Form PAD-17, together with an inventory report on Form PAD-16.

Operators who drilled 40 wells or less during the preceding four quarters must file reports on Form PAD-32, showing wells completed during the third quarter, 1951, and how casing and tubing allotted by PAD were used.

the preparation now of the rationing programs that would be necessary in the event of war is that the next war will hit with a bang and immediately will be on an all-out basis. The country now is in that "preparedness" breathing time which it had between 1914 and 1917 and again between 1939 and 1941, but in neither of those periods was it entirely ready when the United States became involved.

Must prepare. — Now, again, even though the country has been forewarned of the possibility of war, it would take months to get the oil industry, among others, on a complete war basis, and during that period we would not only have to fuel our own tremendous military operations but probably also those of some at least of our allies. Six months of this, it is said, and our stocks would be down to bedrock.

In the last war, it was almost exactly a year after Pearl Harbor before gasoline rationing was imposed on a national scale, although the eastern states were put under control some months earlier.

Rubber Quandary

Selection of feed stocks stumps Senate committee

WASHINGTON. — Proposed expansion of synthetic-rubber production has raised the knotty question of whether to engage in an $85,000,000 18-month program to increase petroleum-butadiene facilities or use the more costly alcohol-base process which might ultimately adversely affect the competitive position of synthetic rubber.

The situation was reviewed in the third report on rubber by the Senate preparedness subcommittee last week in discussing the present 760,000-ton production and plans to expand it by another 100,000 tons. Of the current production, approximately 600,000 tons is from petroleum-butadiene.

The subcommittee pointed out that despite substantial expansion in refining capacity there is no surplus of many petroleum products today, and even the current industry expansion program, aided by government assistance in the form of accelerated amortization, does not promise to make available substantially increased supplies of the products needed for the synthetic-rubber program.

Would take 18 months.—The construction of facilities for 75,000-ton capacity would take approximately 18 months, cost about $85,000,000, and use a "substantial tonnage" of steel, the subcommittee found.

On the other hand, it said, if the more costly alcohol-base process were used, the ultimate competitive position with natural rubber would be adversely affected and it might later be necessary to use more drastic powers of specification to preserve the industry.

"We believe that the final decision as to types of feed-stock material to be used should be made by the operating agency (Rubber Reserve) having responsibility," the subcommittee concluded. "In making the decision, however, we believe that paramount consideration should be the national security with special emphasis on the desirability of preserving the synthetic rubber industry by keeping it competitive with the natural rubber industry."

The second major component of GR-s—styrene—is in very short supply due to the lack of availability of benzene, the subcommittee's study developed.

Benzene supply.—Benzene from petroleum represents a major practicable source for a rapid increase in benzene supply, and the National Production Authority has requested the Petroleum Administration to provide for such production at the rate of 131,000,000 gal. a year as soon as possible. PAD has sponsored the construction of additional facilities for production of 81,000,000 gal. a year and has additional requests pending for another 54,000,000 gal. This program is expected to result in initial production this month with the final goal set for November 1952. By the end of this year, the production from new projects and expansions is expected to be at a rate of 23,000,000 gal. a year and these projects, it was pointed out, also will produce allied chemicals such as toluene, xylene, and other types of aromatic chemicals, many of which are in short supply.

Teapot Dome Area Revived

WASHINGTON.—Recent discoveries of oil by companies operating to the south of Naval Petroleum Reserve No. 3 are bringing the once scandalous and long dormant Teapot Dome to life.

Because of those discoveries, plus the defense program need for oil, the Navy Department plans to drill three wells in the reserve, two of them to the granite.

A $300,000 appropriation has been asked of Congress for the drilling of two of the wells, which will be done by private contractors getting the job by public bidding. Testifying before a Senate appropriations subcommittee, Col. Ottmar F. Kotick, deputy director of naval petroleum reserves, explained the department wants to drill the wells "so as to be able to evaluate the deeper horizons and make a decision as to whether the Navy should go ahead and develop the property."

If the drilling of the wells is authorized by Congress, it is proposed to reopen the inspector's office at Casper, Wyo.

Co-Op Tax Bill Pushed

WASHINGTON.—A new basis for taxation of cooperatives, much milder than that originally proposed, has been written into the new tax bill by the Senate finance committee.

As a substitute for a provision to tax cooperatives on patronage dividends not paid promptly in cash or interest-bearing promissory notes, the committee has adopted a requirement that cooperatives shall be taxable on all earnings not definitely allocated to the accounts of patrons.

Under the revised proposal the Internal Revenue Commissioner is to require the reporting of patronage dividends which are allocated to the accounts of patrons in amounts of $100 or more, and is to have the discretion to require reporting on lesser amounts, and patronage dividends are to be subject to the same withholding requirements as corporate dividends.

Shippers' Tax Rejected

WASHINGTON.—A House proposal to tax shippers transporting oil in their own barges has been turned down by the Senate finance committee.

The House version of the new tax bill called for application of the transportation tax on such movements and on shipments where less than a fair transportation charge is made.

The transportation item is one of a large number on which the Senate committee did not agree with the House, which will have to be ironed out in conference. The revenue legislation is expected to be passed by the Senate within a few days, but not until after another fight has been made, in the course of the debate, to put over the Treasury proposals for reduction of the percentage depletion allowance.

Symbol System Simplified

WASHINGTON.—Simplification of symbols to be used for the procurement of controlled and noncontrolled materials for use in foreign oil operations has been provided in amendments to the M-46A order.

The National Production Authority has abandoned the original idea of using separate symbols for large construction projects and other operations, cutting the number of symbols from 8 to 4.

All controlled materials, whether for large construction projects or other operations, will be procured through the use of the symbols W-4 for ECA countries and W-2 for other areas, and noncontrolled materials will be secured through the use of DO-W-4 for ECA countries and DO-W-2 for other areas.

GULF COAST

Golden Oil Jubilee

Jennings, La., to note 1901 discovery this week

JENNINGS, La.—On September 21 the spudding in of a well by a 1901-style derrick will kickoff the Louisiana Golden Oil Jubilee here, where 50 years ago the oil industry got its beginning in this state.

A wooden derrick complete with 1901 equipment, including boiler, Smith-Vaile pumps, kellys, rotary table, and elevators similar to that used in drilling Jennings Oil Co. 1 Jules Clement was erected on the east outskirts of Jennings and the spudding in is to be witnessed by Bruce K. Brown, deputy administrator for Petroleum Administration for Defense, and Earl Long, governor of Louisiana. Brown will later address the assemblage in outlining industry's current role in national defense.

An exhibit hall has been stocked with the oldest and newest of oil-field equipment showing the marked contrast in the practices now followed as compared to those at the turn of the century.

Jennings field has produced more than 102 billion barrels of oil since it was opened in 1901 and seven wells are currently in operation on a 25-acre tract near the site of the discovery well. Most of the oil produced and the 20 million barrels of anticipated production has been obtained from a 120-acre site.

Current producing wells are owned by the Jennings-Haywood Syndicate which drilled the discovery well. One of the wells is making 50-55 bbl. per day and the others range from 10-40 bbl. per day. A new well is to be drilled to 3,500 ft., about 1,000 ft. deeper than production on the original lease. Other production is anticipated around 9,000 ft. in this area. Other wells recently drilled in the field have obtained pay as shallow as 1,000 ft. and on the edge of the field production has been obtained from depths around 8,000 ft.

Veteran builds rig.—The wooden rig, used in the celebration, was built under the supervision of L. E. (Ed) Dennis, Lake Charles. The 68-year-old veteran of oil-field service which began in 1907 was called out of retirement to oversee the construction—a lost art in these days of portable rigs and steel construction. Dennis said the complete rig is suitable for drilling to about 3,000 ft.

Oil has been a major industry in Louisiana. During 1950 210,435,000 bbl. was produced in the state and Louisiana ranked third in the country for the production of crude oil. Within the state are also located 14 refineries having a crude-oil capacity of 505,200 bbl. per day. Chief among these are Esso Standard Oil Co.'s 245,000-bbl. plant at Baton Rouge, and Cities Service Refining Co.'s 150,000-bbl. refinery at Lake Charles. In addition there are 34 natural-gasoline plants in the state with a daily capacity of 1,380,240 gal.

Tidelands Battle Continues

AUSTIN.—The tidelands controversy continued smouldering with an exchange of views between Solicitor General Philip B. Periman and Texas Atty. Gen. Price Daniel.

Periman said that California, Louisiana, and Texas are blocking development of offshore resources. Daniel retorted that the federal Government was to blame.

In a telegram sent to Senator O'Mahoney of Wyoming, chairman of the Senate interior committee, Daniel said that the states were in the middle of a development program which would have assured continuous production of oil and gas when they were stopped by federal suits. He said that the suits were filed in the face of opposition by a majority of the members of Congress.

Daniel continued by saying that if immediate development is needed for national defense it can be obtained with greater speed through continuation of established state operations.

Periman had complained to O'Mahoney that the states had resorted to dilatory tactics in their fight to have tidelands ownership retained by themselves.

From Louisiana, Atty. Gen. Bolivar Kemp called Periman's action a smoke screen and went on to state that O'Mahoney is bottling up in his committee a bill which would disavow the federal Government's claim to have paramount rights on submerged lands.

A Senate committee will tackle this week a House-passed bill which would give states title to offshore submerged lands.

O'Mahoney announced the interior and insular affairs committee, which he heads, will discuss the bill and other proposed legislation principally affecting submerged mineral resources off the coasts of California, Texas, and Louisiana.

ROCKY MOUNTAIN

Duchesne Well Finds Oil

VERNAL, Utah.—Discovery of a shallow, low-gravity, low-pour-point oil reservoir for Duchesne oil field of Duchesne County was reported this week ½ mile east of the discovery well.

Carter Oil Co. 2 Ute-Tribal, C SE NW 16-4s-4w, recovered 955 ft. of 25°-gravity black oil and 15 ft. of oil and gas-cut mud on a 2-hour drill-stem test from 2,943-3,012 ft. Flowing pressure range from 250 to 350 psig.; shut-in pressure was 770 psig. On last field report, crews were preparing to swab after carrying the well to 3,066 ft.

The discovery well was same interests 1 Duchesne Ute-Tribal, CSE NE 17-4s-4w, which was completed during July 1951 for an initial production of 363 bbl. of 42.9°-gravity oil.

Rank Wildcat Successful

DENVER.—Field interest in the Denver-Julesburg basin was intensified last week when a rank wildcat oil pool was discovered 50 miles due east of this city in Adams County, Colorado. Nearest production lies 15 miles to the northeast in the Little Beaver Creek gas field of eastern Adams County.

The discovery, which marks the first oil production for Adams County, was Ginther, Warren & Ginther, Houston, 1 Noonan Ranch, CNE SW 24-3s-59w. The well swabbed 3 bbl. of oil per hour following casing perforations from 6,193-6,298 ft. in the Muddy series topped at 6,190 ft.

Formations encountered in this well were as follows (electric determinations): Niobrara 5,275 ft., Upper Muddy 6,137 ft., Muddy 6,190 ft., Dakota 6,412 ft., Lakota 6,505 ft. and Morrison 6,560 ft. Total depth is 6,600 ft. and plug-back depth is 6,290 ft.

MEETINGS

A.A.O.D.C Plans Complete

FORT WORTH.—Final plans have been completed for the eleventh annual meeting of the American Association of Oilwell Drilling Contractors, and from all indications, the growing stature of the drilling contractor in providing technical knowledge necessary to meet increasing demand for petroleum and its products will receive special recognition.

The convention will be held in the Texas Hotel here September 23-25.

Among papers to be presented will be: "The Drilling Contractor and the Oil Company," by A. C. Rubel, vice president in charge of exploration and production for Union Oil Co. of California; "Employe Relations," by Ray H. Horton, manager, industrial relations, Humble Oil & Refining Co., Houston; "Manpower Pool in the Drilling Industry," "Lubrication of Oil Field Machinery," "Lost Circulation. Causes and Remedies," "Wire Line Problems," and "Crooked Holes. Methods of Prevention and Correction."

(A special section on the drilling industry begins on page 179).

INTERNATIONAL

MIDDLE EAST

Iran to Sell Oil

Contract with Afghanistan calls for supply of 300,000 bbl. of products; British move to hasten Iranian crisis

Ted A. Armstrong

THE Iranian Government last week signed a contract with Afghanistan under which it promised to supply nearly 300,000 bbl. of petroleum products.

The contract was signed for Iran by Finance Minister Mohammed Ali Varasteh and calls for delivery of the products to the Afghan border.

If consummated, the sale will be the first of Iranian products since tanker shipments by Anglo-Iranian Oil Co., Ltd., were halted in June. Since the refinery at Abadan is shut down, it was assumed the products would be withdrawn from storage.

While negotiations for the sale were in progress, advertisements of Anglo-Iranian were appearing in newspapers throughout the world warning that the company "will take all such action as may be necessary to protect its rights" against any "concerns or individuals" entering into transactions with the Iranian Government.

British action.—The British Government moved to hasten an economic crisis in Iran, by two actions.

First, it said it would not permit further sterling payments to and from Iran. In restricting the convertibility of Iranian-held sterling, Britain's national bank directed its branches to refuse applications for credits to cover imports from the United States, except for those having export dollars, and advised the branches to open credits for sterling purchases only at the applicant's risk.

The action meant, as far as oil sales are concerned, that the oil would have to be paid for in currency of the buying country or in dollars, which few countries have.

Following this move, the British directed all ships carrying "scarce" goods to Iran to turn back or to put in at other ports. The Board of Trade said no additional shipments will be made of goods which are in short supply or which can be sold for dollars.

Activity in Iran.—An ultimatum to Britain warning that all British technicians would be expelled if the British refused to renew negotiations on the nationalization issue was sent last week by Premier Mossadegh to Averill Harriman, President Truman's representative who attempted to persuade the two countries to reach a settlement earlier.

Mossadegh said the deadline for the ultimatum would be 15 days after it reaches London.

While the action was approved overwhelmingly in the Iranian Senate, a boycott of a meeting of the lower house by opposition deputies left the meeting without a quorum and prevented a vote.

Last week this opposition was organized behind former Premier Said Zia ed-Din Tabatabai, who announced the reorganization of the National Will party.

In a statement announcing the reorganization, the former premier avoided any mention of the nationalization question but strongly attacked the present government for its "excesses" and for its steam-roller tactics against its opposition.

Huessin Fatemi, assistant to Mossadegh, announced in Teheran that the government soon will float its $40,000,000 international bond issue authorized recently by parliament and said Mossadegh would personally appeal for a generous response from the public.

At Abadan the British continued to reduce the number of personnel remaining in Iran. An Anglo-Iranian announcement said the number will be reduced to a "hard core" of 350 who will carry out essential refinery maintenance.

Duff in Middle East

Journal's international editor visiting oil areas

DAHL M. DUFF, international editor of The Oil and Gas Journal, is now in the Middle East where he is gathering first-hand information on petroleum-industry operations in this important area.

During his extensive tour of oil drilling, producing, pipe-line, and refining operations, Duff will visit Tapline facilities and terminal; Dhahran, where he will observe operations in Abqaiq, Ras Tanura, Safaniya, and offshore-drilling activity, Bahrein, Qatar and the Trucial Coast, Kuwait, the Abadan refinery in Iran, Beruit, and Tripoli.

Duff will also visit Banias terminal and inspect pipe-line construction work now under way.

Will write articles.—A special series of articles by Duff on facts gathered during his tour will begin in the near future in the Journal.

DAHL M. DUFF

Ted A. Armstrong, district editor, Tulsa, is now handling the Journal's international news section from the New York offices at 500 Fifth Avenue, where Duff and George Weber, refining editor, are permanently headquartered.

LATIN AMERICA

Chile Gets Refinery Loan

Empresa Nacional de Petroleo, the Chilean Government oil organization, has negotiated a short-term loan of $2,000,000 from a private United States commercial bank to begin work on the country's first important oil refinery.

The plant, under discussion for several years, is to be built at Concon, about 15 miles north of Valparaiso. It is expected to be a 15,000-bbl. daily refinery which will operate on imported crude plus production obtained from Chile's own fields in the Tierra del Fuego.

According to a report from Santiago, the empresa produced 374,407 bbl. during the first half of this year. Exports totaling 372,543 bbl. were shipped to Uruguay, to whom Chile is now selling crude under contract pending completion of its own refining facilities.

Principal field in the Tierra del Fuego region is Manantiales. Oil was discovered the latter part of 1950 in the Cerro Sombrero area about 10 miles southeast of Manantiales. Now under construction in the field area is a gas-repressuring and gasoline-

extraction plant which will permit production considerably greater than the present approximately 2,000 bbl. daily. A number of wells are now capped to prevent loss of gas pressure.

Oil Law Opposed

Proposed Peruvian bill inadequate, companies say

OIL companies will "abstain from applying for oil concessions" in Peru if the oil law now being proposed is enacted.

This statement was sent to the president of Peru in a letter signed by representatives of seven companies operating in that country.

Before setting out recommendations for a new petroleum law, the companies condemned the proposed legislation as being far from what the country needs to encourage the development of the Peruvian oil industry. Enactment of the proposed bill, they said, would mean that companies now established in Peru and those which have been waiting 5 years for adoption of a law so that they might apply for concessions would be unable to operate in the country.

The signers expressed preference for a bill submitted to congress by the executive branch of government in 1950, pointing out that it was signed by the president and members of the cabinet and that it was praised by such Peruvian organizations as the Bar Association, the National Mining Society, the National Industrial Association, and the Lima Chamber of Commerce.

This bill, they said, offered attractive terms to both national and foreign oil interests.

What is needed.—The companies urged adoption of a law incorporating the following principles:

1. Elimination of export duties, establishing instead an income tax with an adequate depletion exemption.

2. Reduction in surface rentals to permit prospecting and developing of both low-productivity fields and those whose development entails considerable expense.

3. Practical measures to stimulate the investment of private capital, without discrimination as to nationality.

4. Clear specifications under which concessions might be canceled and exact provisions covering other interests of the concession holder.

The companies told the government the need for a new law is urgent and warned that Peru is fast approaching the time when it will cease to be an exporting country and will have to import part of its requirements.

By 1953, the letter said, Peru will have to import fuel oil, and by 1957 it will be importing gasoline and other products.

The document was signed by representatives of Cia. de Petroleo Ganso Azul, Ltd.; Cia. Peruana de Petroleo el Oriente; Cia. Petrolera Lobitos, S.A.; Conorada Petroleum Corp.; International Petroleum Co., Ltd.; Richmond Oil Co.; and Socony-Vacuum Oil Co. del Peru, S.A.

ASIA

New Plant Proposed

India wants companies to build 40,000-bbl. refinery

THREE international oil companies, California Texas Oil Co., Ltd., Standard-Vacuum Oil Co., and the Burmah-Shell organization, are now studying a proposal from the Indian Government that they build a 40,000-bbl. daily refinery in the country.

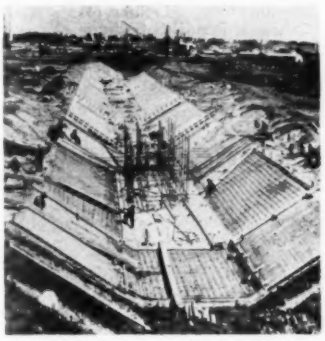
According to reports from New Delhi, the Indian Government's proposal to the companies was made as a result of the shutdown of the Iranian oil industry. India has been particularly affected by the closing of the Abadan refinery from which it formerly obtained much of its requirements.

The Indian Government's proposal is that the companies agreeing to the plan should have full control over both capital and management. The government for its part would guarantee not to nationalize the operation for at least 30 years and also that if nationalization came later, due compensation would be paid.

The government's plan calls for either a 2,000,000-ton (40,000-bbl.) refinery at Bombay State or two of 1,000,000 tons each, one of them in Bombay and the other in Madras State.

Would supply needs.—The refinery would be able to supply about two-thirds of India's estimated needs of 3,000,000 tons (approximately 60,000 bbl. daily) of petroleum products annually. Nearly all of India's present petroleum requirements are imported. The only domestic oil operation is that of Assam Oil Co., Ltd. (Burmah Oil Co., Ltd.) which produces and refines about 5,000 bbl. daily at Digboi in Assam.

The government's aim in making the proposal to the companies is to save foreign currency represented by the difference in cost of imported crude as against imported products. The government also is anxious to establish an important industry, as well as to attempt to assure against a cutoff of its supplies such as has occurred as a result of the nationalization in Iran. Although the lack of aviation gasoline has curtailed flying in India, major shortages of most products has been averted through stop-gap supply arrangements made by the major international companies.



Refinery "Pipe Line"

Sea water will flow through this concrete channel to serve as cooling water in the new Kent refinery of Anglo-Iranian Oil Co., Ltd., now under construction in England. A 16,000,000-gal. reservoir is now being built to hold water taken from the sea by a tidal intake. Water will flow from the reservoir to the main pump house through this 4,000-ft. channel. The Kent refinery originally was designed to process 40,000,000 bbl. daily. Design capacity later was doubled, and the refinery is expected to be operating at a rate of 80,000 bbl. daily by the end of 1952. Upon completion, the refinery will be the second largest in Britain and one of the largest in Europe. (Photo courtesy Anglo-Iranian Oil Co., Ltd.)

New Drilling Planned

Burmah Oil Co. (Burmah Concessions), Ltd., will begin drilling late this month on the first postwar wells in the Chauk area in central Burma.

The company plans to drill several wells and deepen others to forestall an expected decline in production in the area and provide a constant supply of crude to the B.O.C. refinery at Chauk. Present production is about 2,000 bbl. per day.

In Rangoon a company announcement said the drilling would be done by Burmese crews operating under a B.O.C. geologist, who recently arrived in the Chauk area. Only one will be drilled at a time.

The Chauk refinery, which has been primarily a topping operation processing about 2,000 bbl. per day, is now being expanded by the addition of a two-stage distillation unit and other equipment. The refinery expansion, together with the drilling program, reflects the company's plan to operate the field at its maximum economic capacity.

PERSONALS

Gets New Post

Richfield exploitation head moves to vice presidency

RICHARD D. MONTGOMERY, who has been manager of the exploitation department of Richfield Oil Corp. since 1937, has taken over his new duties as vice president of the corporation. In this capacity he will direct Richfield's exploration, drilling, production, and gas-department operations.

A veteran of more than 35 years in the oil industry, he has been associated with the firm since 1926, when he became head of the land department. In 1931 he took charge of production, land, and engineering, continuing in the post until he became manager of the exploitation department.

A native of Los Angeles, Montgomery was graduated from the University of California in 1911 with a degree in mining engineering. He was associated with independent oil companies operating in the Taft and Maricopa districts of Kern County, California, from 1911 to 1913, after which he was engaged in mining in the State of Durango, Mexico, until 1916.

In 1916 he joined Standard Oil Co. of California. During the next 10 years with the firm he served as field engineer in Whittier, Calif., resident engineer in Bakersfield, Calif., and engineer in charge of development in Brazil, Panama, Costa Rica, Colombia, Ecuador, and Venezuela.

He resigned from Standard in 1926 joining Richfield as head of the land department.

E. B. Clark and **Lee Roy Fuson** have formed Clark & Fuson Drilling Co., with headquarters at Alice, Tex. Clark is president and will be in charge of the company offices, and Fuson is vice president in charge of field operations.

Walter A. Smith, drilling supervisor for Failing Exploration & Drilling Co., has been transferred from Sonora to Waco, Tex.

Albert A. Woll, general manager for Loeb Oil Co., has been transferred from Evansville, Ind., to Lawrenceville, Ill.

John W. Cox, petroleum engineer for Phillips Petroleum Co., has been transferred from Eureka, Kans., to Odessa, Tex.

Jim Tooley, formerly with Kewanne Oil Co., has joined Ferrell Drilling Co. at Great Bend, Kans., as assistant to **J. D. Ferrell,** president.

T. W. G. Richardson, development engineer for Shell Oil Co., has been transferred from Midland, Tex., to Tulsa. Other changes in the firm include: **F. W. David,** drilling foreman, transferred from Odessa, Tex., to Hobbs, N. M.; **E. E. Temple,** mechanical engineer from McCamey, Tex., to Odessa; **J. E. Woodward,** gas engineer, from Midland to Shell's Wasson, Tex., gasoline plant; **R. C. Cabaniss,** junior exploration engineer, from Houston to Midland; and **W. J. Fairbanks,** junior mechanical engineer, from Midland to Houston.

Norman Hardy has been elected a vice president of Arabian American Oil Co. His headquarters will be in Dhahran, Saudi Arabia. Hardy, former president of Richmond Petroleum Corp., a subsidiary of Standard Oil Co. of California, joined Aramco last February. He entered the oil industry in 1926 as a geologist for Standard of California. In addition to the United States, Hardy has served in Indonesia, Holland, and South America.

J. Robert Horner, of Clarksburg, W. Va., president of Delaware Gas Co., and Washington Gas Co., has been elected president of the West Virginia Oil and Natural Gas Association for 1952. **G. Allan Reid,** of Parkersburg, W. Va., president of South Penn Natural Gas Co., and vice president of South Penn Oil Co., wes elected vice president of the association. **Hardin R. Harmer,** of Shinnston, W. Va., was reelected secretary-treasurer.

Richard P. Knapp, senior petroleum engineer for Humble Oil & Refining Co., has been transferred from Houston to the London district at Overton, Tex.

Russell Sparenberg, geologist, and **J. K. Adams,** landman, for Texas Eastern Production Corp., have been transferred from Shreveport to Houston.

F. E. Harvick, Austin, has been named director of the newly created liquefied - petroleum - gas division of the Texas Railroad Commission.

Van Thompson has been appointed manager of Southern Union Gas Co.'s newly created exploration department, and **N. P. Chesnutt** has been

VAN THOMPSON

N. P. CHESNUTT

named chief engineer. Thompson joined the firm in 1929, was transferred to Dallas as engineer and superintendent of gas measurement in 1938, and became head of the engineering department in 1945. Chesnutt joined Southern Union in 1935 and was West Texas district engineer in 1941 when he entered the Army. He rejoined the firm on his return from military service and served as field superintendent in northwestern New Mexico, supervising the construction of the firm's natural-gas treating plant. Since 1948 he has been in the Dallas office doing research and supervisory work on special projects and assisting in general activities of the engineering department.

L. L. Harrison, assistant foreman for Sohio Petroleum Co., has been transferred from Russell, Kans., to Midland, Tex., and promoted to foreman.

Joseph W. Meehan, veteran Pure Oil Co. pipe liner, has been appointed general manager of Pure's pipe-line and crude-oil purchasing departments. A native of Chicago, he has been with the firm for almost 20 years. In addition to service in Chicago, he has been chief of the Pure transportation division at Mount Pleasant, Mich., and superintendent of Pure pipe-line operations with headquarters in Olney, Ill. He will continue to make his headquarters in Chicago.

PERSONALS

I.S.A. EXECUTIVE COMMITTEE.—Above are executive-committee members of Instrument Society of America, who were photographed during the Sixth National Instrument Conference and Exhibit in Houston last week. Front row, left to right: George Feeley, treasurer; Robert Sheen, new vice president; J. B. McMahon, outgoing president; A. O. Beckman, president-elect; W. A. Wildhack, vice president; and N. L. Isenhour, vice president. Back row, left to right: Richard Rimbach, executive secretary; Percy Jones, newly appointed business manager; Porter Hart, and Nelson Gildersleeve, outgoing vice presidents; and Dave Boyd, new vice president.

Arthur Gayle, formerly chief exploitation geologist for Pan American Production Co. in Houston, has been named exploitation geologist for the Corpus Christi district of The Chicago Corp. **Howard Gibson,** geologist, has been transferred from Corpus Christi to Denver, to become assistant to **C. R. Nichols,** Rocky Mountain representative.

G. R. Torberg, Jr., has been transferred from the process department of Esso Standard Oil Co.'s Bayway refinery at Linden, N. J., to the company's East Coast division, where he has become assistant coordinator in charge of crude and fuel-products allocation. He is succeeded at Bayway by **Rollen Schiefelbein,** formerly engineer in the refinery's technical-service division.

John E. Mital, senior technologist at Shell Oil Co.'s Houston refinery, has been transferred to Shell Point, Calif., as chief technologist. Mital joined Shell at Wood River in 1937. **Hugh Wynne,** senior engineer in the engineering department at the Houston plant, has been promoted to chief engineering inspector. **Arthur P. Towell,** engineering inspector, has been transferred from Houston to Shell Point as chief engineering inspector.

Ted Trafford, former manager of Home Oil Co., Calgary, Alta.; **Bob Pot,** former chief reservoir engineer with Imperial Oil Co., Ltd.; and **Peter Klaui,** former division geologist in Alberta for Bay Petroleum Corp., have formed the geological and petroleum-engineering consulting firm of Stafford & Associates in Calgary.

Merrill W. Haas has been appointed chief geologist for Carter Oil Co. and **Lee C. Lamar,** assistant chief geologist. Haas has been with Standard Oil

M. W. HAAS

LEE C. LAMAR

Co. (N. J.), and affiliates for 17 years and recently has been staff geologist with Carter in Tulsa. He has served as research paleontologist for Humble Oil & Refining Co., chief paleontologist for Standard in Venezuela, and division geologist for Creole Petroleum Corp. Lamar joined Carter in 1932, was district geologist in Michigan, and since 1947 has been on Carter's geological staff in Tulsa.

Dr. E. L. DeGolyer, geologist who heads the firm of DeGolyer & MacNaughton in Dallas, has been elected an honorary member of the American Institute of Mining and Metallurgical Engineers.

R. W. Abbott has been named assistant process and stock coordinator at Esso Standard Oil Co.'s Baltimore refinery. At the same plant, **Donald Latimer** has been promoted to group head in the technical department.

W. D. Corley, drilling and production superintendent for United Gas Co., has been transferred from Alexandria, La., to Yazoo City, Miss.

J. H. Raley, Shell Development Co. research chemist whose field is reaction kinetics, has been assigned to the Houston refinery for a 2-year period. Other chemists who were temporarily transferred to refineries in order to obtain broader experience with refinery operating problems include: **J. W. Otvos,** who has been using isotopes to investigate reaction mechanisms; and **G. E. A. Wyld,** analytical chemist. Both go to the Wood River, Ill., refinery.

August Pyre, who has been associated with Gulf Oil Corp. for the past 10 years, has been named manager of Danish-American Prospecting Co. in Denmark. He will be in charge of exploration activities of the firm, now active on the island of Funen and the Jutland Peninsula.

R. W. Faulk, assistant superintendent at Shell Oil Co.'s Houston refinery from 1946-49, has been appointed to the newly created position of manager of manufacturing for Shell Oil Co. of Canada, Ltd., at Toronto,

PERSONALS

and will be responsible for the executive direction of Shell's refinery operations in Canada. A graduate of Southwestern Louisiana Institute, Faulk started with Shell as a laboratory tester in Houston in 1929. Since leaving Houston, Faulk has been assigned to the head office in New York.

Archie W. Brown, district schedule man in Magnolia Petroleum Co.'s Rusk, Tex., district, has been promoted to field foreman in the Pegasus, Tex., area of the Kermit natural-gas district. **Paul W. Taylor,** plant foreman, has been transferred from Kenova gasoline plant near Smackover, Ark., to Hickok gasoline plant located at Ulysses, Kans.

Joe Wood, chief chemist for Skelly Oil Co. at Pawhuska, Okla., has been appointed chairman of the technical committee of the Natural Gasoline Association of America. Wood succeeds **H. A. Montgomery,** Warren Petroleum Corp., Houston, who finishes a 3-year term. **J. L. Thompson** was named vice chairman of the committee. New chairman of the high-pressure-absorption committee is **Dr. E. H. Koepf,** Atlantic Refining Co., Dallas. **A. J. Miller,** Phillips Petroleum Co., Bartlesville, Okla., will continue to head the fractional-analysis subcommittee, and the plant-control-test subcommittee will remain under the direction of **K. C. Bottenberg,** also of Phillips at Bartlesville.

Harold E. Snider, intermediate petroleum engineer for Sinclair Oil & Gas Co. at Sand Draw, Wyo., has been promoted to assistant district foreman. Other Sinclair changes include: **Herman L. Hensel,** junior petroleum engineer at Oklahoma City, promoted to intermediate petroleum engineer, and transferred to Delaware, Okla.; **Charles J. Eskridge,** senior petroleum engineer at Pampa, Tex., promoted to district foreman, and transferred to Odessa, Tex.; **Robert E. Nichols,** gang pusher at Thrall, Kans., promoted to assistant district foreman; **Herbert T. McCormack,** gas foreman at Delaware, promoted to assistant district foreman; **Fred W. Kunkel,** junior petroleum engineer at Bairoil, Wyo., promoted to intermediate petroleum engineer; **George V. Dunn,** intermediate petroleum engineer at Lindsay, Okla., promoted to senior petroleum engineer, and transferred to Seminole, Okla.; **George Platt,** intermediate petroleum engineer at Kiefer, Okla., transferred to Tulsa; **W. H. Upton,** district foreman at Alma, Okla., transferred to Kiefer; **Wyatt L. Sisson,** district foreman at Kiefer, transferred to Alma; and **Elmer L. Mikeman,** gang pusher at Drumright, Okla., promoted to construction foreman.

W. H. Newman has been promoted from marine-drilling-tools supervisor in Magnolia Petroleum Co.'s Louisiana-Gulf division to assistant drilling-tools superintendent of the Gulf Coast division.

S. A. Wickstrom, petroleum engineer, has been elected assistant vice president in the oil and gas department of the Second National Bank at Houston. Prior to joining the bank he was assistant division engineer for Stanolind Oil & Gas Co.

W. F. Youngblood, tool pusher for Penrod Drilling Co., has been transferred from Snyder to Clarendon, Tex.

F. T. Neese, seismograph engineer for Carter Oil Co., has been transferred from Colorado Springs, Colo., to Wolf Point, Mont.

Bob W. Wright, formerly purchasing agent for Placid Oil Co. at Shreveport, has resigned and joined Brazos Oil & Gas Co. at Houston as purchasing agent.

Leo W. Stach, head of the petroleum branch, natural-resources section, general headquarters, Supreme Commander for Allied Powers, received a certificate of achievement from General Ridgeway's chief of staff at the termination of nearly 6 years' service. As petroleum geologist during the occupation of Japan, Stach was responsible for rehabilitating the Japanese petroleum-producing industry to the extent that both production and proved reserves of crude oil in Japan are now nearly double what they were at the beginning of the occupation.

C. S. Killgore, district geologist for Continental Oil Co., has been transferred from Shreveport to Midland, Tex., as assistant division geologist for the Midland division.

Kenneth R. Lewis has been transferred from Henderson, Tex., to Shreveport by Stanolind Oil & Gas Co. as gas-measurement engineer for the northern Louisiana-southern Arkansas district.

N. M. Baird and **R. F. Sawyer** have been appointed assistant managers of the production department in charge of American Republics Corp.'s newly created northern and southern areas. Both men will be headquartered in Houston. Other changes include: **H. H. Morgan,** drilling superintendent in the eastern division at Beaumont, Tex., named to replace Sawyer as operations superintendent; **Charles R. Mote,** assistant to the western division superintendent, promoted to drilling rig foreman at San Angelo, Tex.; and **Walter J. Howland,** named to succeed Mote.

DEATHS

George M. Vandaveer, Jr., 49, vice president of production and engineering for Mid-States Oil Corp., died September 17 in Tulsa. He started his oil career as a roustabout with a pipeline crew, and was associated with Mid-West Refining Co., Stanolind Oil & Gas Co., Phillips Petroleum Co., and the late Ed Moore, independent operator, before joining Mid-States in 1940 as chief petroleum engineer. He was named vice president in 1949.

A. Tory Peterson, 74, retired veteran of United Natural Gas Co., died September 11 at Oil City, Pa.

Howard M. Morton, general manager of Quaker State Oil Refinery of Canada since 1932, died recently in Toronto.

Robert Groh, 32, accountant for Stanolind Oil & Gas Co., died in Tulsa September 15.

Edwin Elliot, 86, retired core driller in early-day Tulsa oil fields, died September 17 in Tulsa.

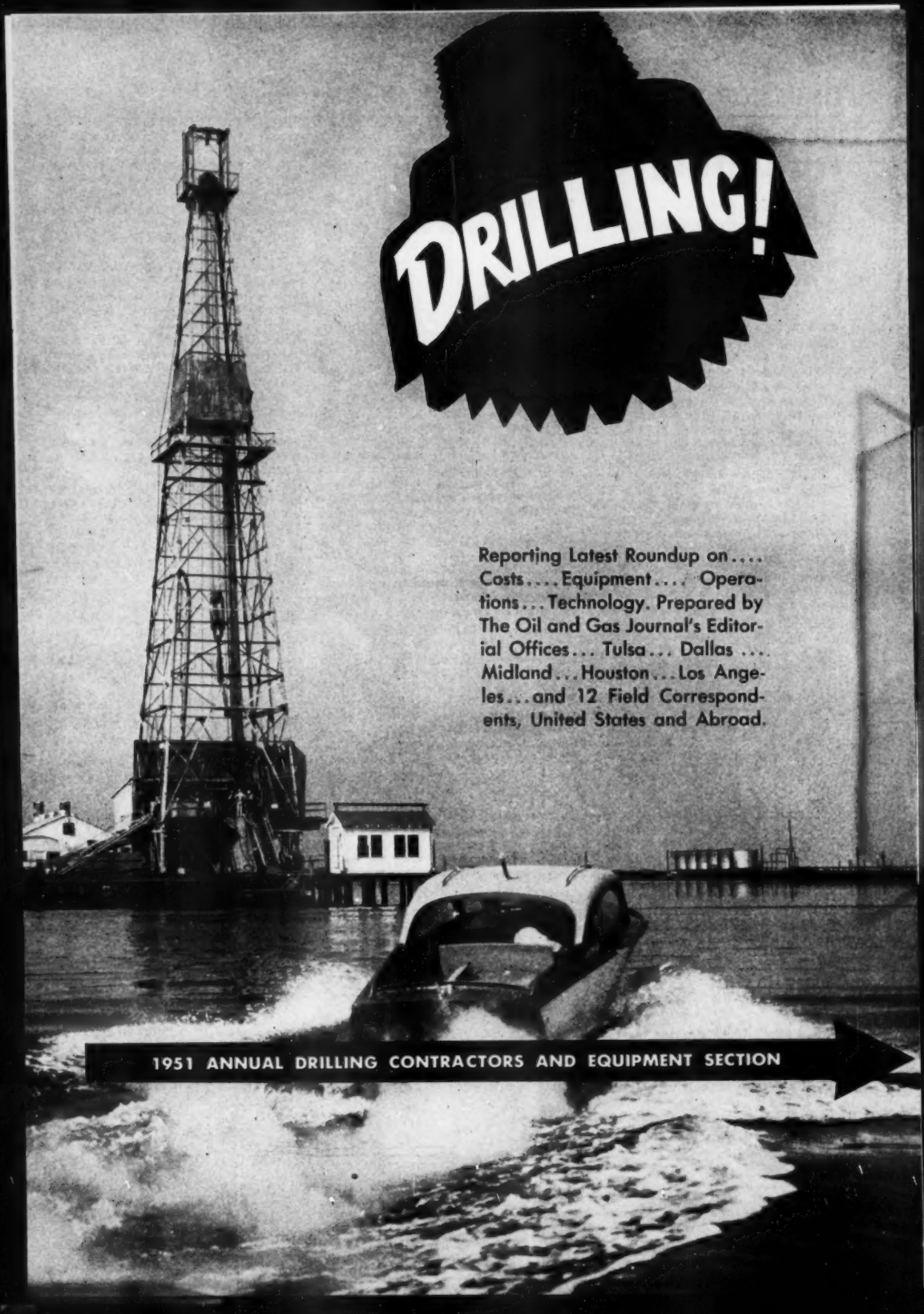
Leonadus H. Sharp, 75, retired production-department veteran of Atlantic Refining Co., died September 12 in Tulsa. He retired from the firm 10 years ago after 23 years in the production division. For a time he was production superintendent at Seminole, Okla.

Alfred W. Hibler, Sr., 58, of Esso Standard Oil Co.'s Bayway refinery, Linden, N. J., died in Linden September 13.

Wells H. Rutherford, Sr., 51, industrial-relations executive with Stanolind Oil & Gas Co., died September 12 in Tulsa.

Hugh M. Stephenson, 54, manager of Brooklyn and Queens operations for Petroleum Heat & Power Co., died September 10 in New York City.

Clyde A. Steinberger, 71, retired independent oil producer, died September 15 in Tulsa. From 1919 until he retired in 1949, Steinberger was president of Pioneer Drilling Co.


DRILLING!
Reporting Latest Roundup on.... Costs....Equipment.... Operations...Technology. Prepared by The Oil and Gas Journal's Editorial Offices... Tulsa... Dallas .... Midland...Houston...Los Angeles...and 12 Field Correspondents, United States and Abroad.
1951 ANNUAL DRILLING CONTRACTORS AND EQUIPMENT SECTION

Mounting Costs Eyed

Drilling contractors strive to cut expenses in order to give customers better service in face of rising prices

THE contract-drilling industry is today faced with diverse situations and problems. The position of the contractor can be said to be both enviable and unenviable.

Today's contractor has a right to be proud of the job he is doing. Ample evidence of the kind of job is given by the number of producing companies which are increasingly shifting to contract drilling and disposing of their own drilling equipment. Reason? The contractor is drilling as well and as cheaply, or better, than can the producing companies. This at the same time relieves the producing companies of a large capital investment in equipment, and an even larger investment in mental strain.

For example, The Texas Co. is reported to be disposing of all its rigs on the West Coast, and resorting to contract drilling in its operations.

Contract drilling has grown by tremendous strides in recent years because along with drilling an increased percentage of the wells, the total number of wells has grown enormously, and the depth of these wells has increased. Therefore, the share of the total footage drilled to which the contractor can lay claim—and this is the true measure of the amount of drilling—is even greater than would appear at first. Drilling efficiency too is at an all-time high. Contractors are drilling nearly 50 per cent of all the wells drilled, compared to about 10 per cent 10 years ago.

And it is only reasonable that the contractor should be drilling most of the wells because all of his attention is directed toward that function. He devotes all his efforts to assembling efficient crews and the best equipment and to the adaptation of new methods so that he can make hole better and faster. He is a specialist in drilling operations.

Drilling erratic.—Also, the producing companies' drilling programs are erratic. During some periods of the year an oil producer is drilling a large number of wells and during other times has few drilling operations under way. Since the contractor serves a large number of producers, his work can be reasonably continuous, but if the producer is drilling with his own tools, he must maintain a large inventory of equipment to meet the peak drilling program, and necessarily have equipment stacked during slack periods. It is to his advantage therefore to employ the services of the contractor.

Too, the contractor can be proud of the role he has played in improving the lot of the driller and the roughneck. Working conditions on the rigs are now the safest they have ever been and wages are at an extremely high figure. Contractor contributions to old-age benefits and workmen's compensation funds are large and becoming larger, growing along with the contractor payrolls. And, strangely enough, these benefits and improvements have been brought about at the same time as an increased drilling efficiency or rate per rig—certainly not a case of "haste makes waste."

Contribution to workmen's compensation insurance rose 15 per cent in 3 years, and old-age-benefit contributions rose 50 per cent in the same period. Employe life insurance climbed 14 per cent in the same 3 years.

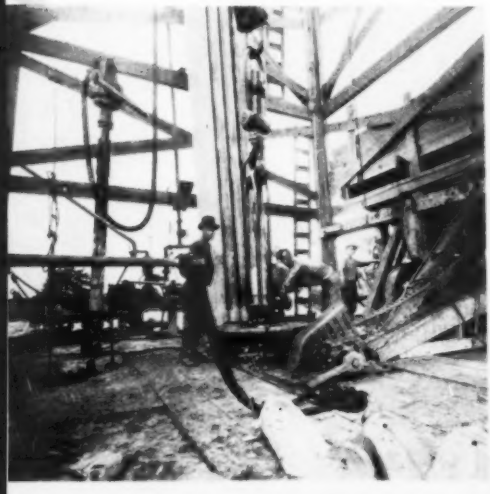
Another picture.—But all this has been presenting the bright side of the picture, and that isn't all there is to see. Perhaps contractors have grown too much, and maybe they are paying out too much money in wages and benefits. And the ever-present spectre of federal control throws a shadow on the bright side. And steel shortages may affect contractors as has nothing else in recent years.

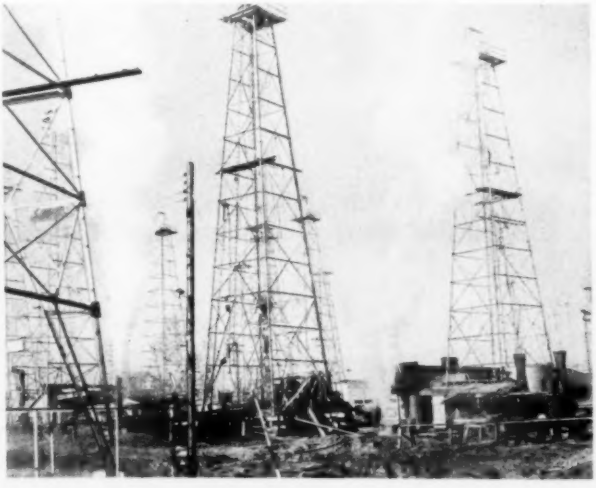
For example, the rapid growth of the drilling industry has taken place not only in the number of rigs running but in the number of contractors. Each of these contractors is after business; he wants his rigs to be working. But because of any one of several circumstances the rigs may be shut down.

Keen Competition

In a business with as many individuals and individualists as there

WHY COSTS WERE LOW.—Years ago, when the photograph at left was taken, drilling costs were comparatively low, and were more in line with tonnage and day-work prices prevalent in those days. Overhead was down and a drilling contractor could drill a well for less money because of lower repair costs, lower wages for workmen, lower insurance rates, and lower prices for equipment. But it took longer to drill the wells. When East Texas came in, such scenes as the one at right became common, as the drilling contractor learned new time-saving tricks to punch his holes down quickly, and efficiently.





are in the drilling-contracting game, competition becomes very keen. And with competition comes a shaving of profit margins and a taking of large risks for less and less return. This situation prevails today, particularly in areas that develop very rapidly and over a large area such as in West Texas, the Scurry reef play, and currently the widespread Spraberry sand development. Ultimately, if this competition is given free rein, although it is undoubtedly essential to maintain a strong and healthy industry, only the most efficient contractors can expect to keep rigs running. For a short time at least, the price cutting may be harmful to those contractors who do not have a number of more profitable operations under way at the same time—this puts the "bite" on the small contract operator.

But another angle is that the small contractor will often himself cut the price to a low figure to keep his rigs busy without running the expense of long expensive moves to a new area.

Costs to the contractor are now higher than ever before. According to surveys conducted by the American Association of Oilwell Drilling Contractors, in the 10-year period from 1941, and using 1941 figures as 100 per cent, labor costs have risen to 190 per cent, equipment to 175 per cent, and miscellaneous costs to 175 per cent. Revenue of the contractor per foot of hole drilled is the same as it was in 1941, while rate of penetration has increased to only 135 per cent compared to 1941.

Other costs have risen too. Supervision and maintenance costs have climbed at a rapid rate. All equipment associated with a drilling rig is much more expensive now than it was as recently as 2 years ago. This includes all items, from the smallest hand tools to mud pumps, engines, and derricks. Such rig supplies as bits, wire line, soft rope, and other materials have increased an average of 17 per cent in 3 years. Transportation costs are also on the upgrade.

Record keeping.— A considerable item in overhead costs is the preparation of the great number of records and reports required by the Government for taxation and benefit purposes. And now, added to this burden, have been all the forms and requests necessary to obtain steel and machinery through the various national agencies charged with allocating these materials.

Deeper Wells

A part of the increase in drilling costs is due to the increasing average depth of all wells drilled. As holes become deeper and deeper, more rig time is lost in nonhole-making activity such as round tripping to change bits and the many electric-logging and drill-stem tests that are run in the deeper holes. One representative drilling contractor reports that "making hole" time decreased 16 per cent in 3 years. At the same time, however, with greater depth, day-work drilling enters and confuses the footage-price picture.

However, no matter how you look at it, the rates for drilling, compared to the costs to the contractor, are low and there are possibilities that they may be driven down even farther. This will not occur if the drilling of wells is kept at its present high rate, but if for any reason the projected nation-wide drilling program falls off contractors are going to be hurt.

Steel supply.—National petroleum agencies have allocated enough steel for the drilling of 44,000 wells. If this steel is forthcoming, the contract-drilling business should remain good. But if this steel in the form of tubular goods is not made available, drilling programs will be curtailed and rigs will be idled. At the present time it seems as though enough steel is available because drilling is at record highs. More than 2,720 rigs were running in the first part of September, 510 more than a year ago. In fact, the number of rigs running so far this year has averaged about 300 more than last year.

Along with the immense drilling activity, of course, has been a jump in footage drilled and a rise in the number of wells completed. The average footage per well has increased again, and will increase even more. Predictions are that the average depth in the last half of 1951 will be 3,934 ft., 261 ft. deeper than the average well for the same period last year. If steel is made available, by the year's end about 44,500 wells should have been drilled.

Investigations are under way to determine the cost of maintaining a producing capacity of 1,000,000 bbl. per day above actual consumption, this figure being the amount deemed necessary in the event of entry of the United States into a large-scale conflict. If such excess producing capacity is found to be necessary, it will require the drilling of many more wells than the current rate, since daily needs are being met with just a little excess caapcity, and at the same time, demand for petroleum and petroleum products is growing.

Inroads of the armed forces on the manpower supply has had some effect upon drilling-contractor personnel, particularly the younger men

***WHY COSTS ARE UP.**—Comparison of equipment shown here with that shown in the photographs on opposite page should leave little doubt as to why costs to the drilling contractor are mounting. He must get better footage prices and day-work rates in order to help offset the rapidly increasing operational expenses. Many hundreds of thousands of dollars are involved when he purchases a rig, and a barge-type job such as the one shown at right costs well over $1,000,000. Repairs, maintenance, increased wages and insurance rates, and depreciation all add to his costs.*

who are starting at the bottom of the ladder as roughnecks. Adequate protection of the manpower supply must also be afforded by government agencies if drilling programs are to be met. A drilling crew must have alert, intelligent, and well-trained members if it is to function properly.

Completion costs.—It is estimated that the average completion costs of wells is approximately 20 per cent of total well cost, and with the industry spending over $1,000,000,000 per year to drill and complete wells, it is readily apparent that several hundred million dollars are spent annually on well completions.

T. A. Huber, chief reservoir engineer for Humble Oil & Refining Co., Houston, together with T. O. Allen and G. F. Abendroth, also of Humble, in estimating this percentage, report that a substantial proportion of today's increases over prewar costs results from expenditures made for formation-evaluation services and other completion items, especially in the development of multireservoir and multizone reservoirs.

The need to provide similar information services and testing procedures in an intensified effort to locate and define commercially productive reservoirs is reflected in a part of this increase.

They report that further costs, ranging from 15 to 25 per cent of the lease and well expense may be incurred during depletion of a reservoir for subsurface reconditioning work, including mechanical repairs and workovers.

The Humble trio points out that many well-completion programs are now being planned in light of improved knowledge of reservoir performance and present-day producing requirements, with emphasis being placed upon satisfactory reservoir drainage and sufficient well capacity with a minimum number of recompletions per well.

Other cost factors.—In reviewing the economics of contract drilling in California, R. A. Powell, secretary-treasurer of Santa Fe Drilling Co., Santa Fe Springs, Calif.—a firm which now has 13 rigs running in various California areas—outlines the changes which have occurred within the past 3 years in the contract-drilling business.

The worker's lot, Powell reports, has been a constantly improving one, both in the matter of remuneration and the conditions under which he labors. The safe conditions which are now being provided for the contract-drilling worker may in the long run be a profitable investment for the contractor, but it represents an immediate and in some instances sizable expenditures.

Wages

Powell points out that the driller's take-home pay has been increased during the last 3 years by approximately 26 per cent. He gets $20.20 per day before taxes. Then there is the cost of workmen's compensation insurance, which has risen some 15 per cent to a present manual rate of $6.15 per $100 of payroll because of increased cost of medical, surgical, and hospital services. Federal old-age-benefit contributions have risen 50 per cent from 1 to 1½ per cent of the first $3,000 of earnings. And so-called "fringe" items, during this same period, have become more and more costly. As an example, employe life insurance has jumped 14 per cent, he reports.

Everything up.—There is nothing in the business under the heading of employe protection and benefits that hasn't climbed steadily, costwise, during the past 3 years. Labor and supervision per crew day have increased from $329 to $430 in 1950, or an over-all increase of 30 per cent.

In reporting on the rise in cost of equipment and tools, Powell states that some hand tools have gone up in price as much as 100 per cent during the last 3 years. Soft rope is up 20 per cent from $0.44 to $0.53 per pound. Wire lines are up 46 per cent from $0.26 to $0.38 per foot.

Other items which have risen sharply are costs of moving a rig, and other activities involving transportation to and from location. And in addition, one of the troublesome cost items is depreciation, which Powell terms the "No. 1 bugaboo" of the contract-drilling business. Although a large item of cost, its basis is indeterminate and in many respects, illogical.

Powell states that the total daily cost of operating a drilling rig was $938 per day in 1947. In 1950 the same rig costs $1,162 per day, or an over-all increase of 18 per cent.

It is significant, Powell states, that approximately 72 per cent of all drilling costs are chargeable to time. The drilling contractor must in consequence budget his time with the utmost care, and never relax his efforts to remove every impediment to the drilling process.

DRILLING PRICES

Drilling-Price Survey

Journal finds rig supply short. Mounting costs will necessitate increased contract rates, footage prices

A DETAILED survey just completed by The Oil and Gas Journal on current representative drilling prices and costs shows many contractors now to be in, simultaneously, a state of feast and famine. The "feast" is the terrific demand for rigs. One contractor reports, "Companies are calling us every day actually pleading for rigs—any number—and in some areas for all the rigs we have."

The "famine" side is that the drilling contractors, by and large, are still working at rates which do not return a reasonable profit—and for some contractors and for a lot of wells that are drilled, no profit at all. One group of 27 different drilling contractors running 57 rigs, reported that for the past 12-month period the total net profit on their drilling operations was only $114,587.95, or 2.68 per cent. This minute return covers a total rig investment (residual) for these contractors of $4,283,274.82. Based on replacement values, net return was 1.58 per cent. These figures were compiled by an independent firm of certified public accountants.

The Journal's survey, taken field by field and area by area, was compiled after interviews with a number of representative contractors and oil companies, both large and small, who let contracts to drilling firms. Many informative data and significant facts showed up in the polls.

The survey further reveals that: (1) Demand for rigs is at an all-time high; (2) contractors as a whole definitely are busier than they ever have been; (3) but it's the same old story—contractors are working under a terrific economic burden because they cannot get satisfactory prices for their work to help offset the rapidly increasing costs of operation.

The biggest complaints, naturally, are the rising costs of equipment, labor, and operational overhead. Contractors contend that the field prices and day-work rate have not risen appreciably to offset these rising costs.

Among reports received by the Journal in its rotary-drilling-contractor survey were:

Quote 1.—"Economic conditions are teaming up to 'whip' us out of business. By economic conditions we mean increased costs for equipment, repairs, and replacements; higher labor costs, including workmen's compensation, insurance, etc., and increased overhead. But the drilling prices we get have not gone up proportionately."

Quote 2.—"In the midst of more business than ever before, we are, in a financial sense, working ourselves to death—by being underpriced right out of business."

Quote 3.—"Unless we can wrangle a higher footage and day-work rate from our clients in the near future in

Field Prices—Is There an Average Now?

The following tabulation is made from actual contracts let during the past 12 months. Some of the prices shown here, however, may no longer exist, now being higher due to rig scarcity and increasing costs.

Field—	Footage Price*	Contract depth Ft.	Day work Rate	Total Footage	Days Day work
TEXAS—Permian basin					
Andector Ellenburger	$7.25	8,500	$700	55	4
Anton-Irish	5.25	6,100			
Cedar Lake	4.25	4,700	500	20	3
Cogdell	5.75-6	7,000	575-700	40	8
Diamond "M"	5.75	7,000			
Dollarhide	7-7.75	to 8,300	800		
Fort Chadbourne	5.00	5,300	575	28	3
Fowler	8.50	10,400			
Fullerton	6.00	7,200			
Fullerton 8,500 ft.	6.45	8,750			
Fullerton-S. Ell'nbrger	6.45	11,000			
Goldsmith, 5,600 ft.	5-5.50	5,400	575-600	29	1
Goldsmith - Clearfork	5-5.75	6,300	575-600	34	3
Midland Farms	3.00	4,700	500	15	1
North Cowden Deep	4.75	5,200			
North Knox City	4.00	4,250			
Pegasus	9.50-10	to 11,500	950-1025		
Ropes, Hockley County	8.25	9,500	825		
Slaughter	3.25	5,100			
South Cowden	4.00	4,200	500	15	1
South Haskell	3.75	3,600	500	18	5
Sweetie Peck	11.00	to 13,000	1000		
Tex Harvey-Spraberry	6.00	7,000	700-725	30	2
Three Bar	6.50	8,300			
Wheeler Devonian	6.75-7.50	8,600	700	55	6
Yarborough-Allen	6.75	10,900			
Wellman	7.75	9,900	725	70	8
North Texas					
N. Knox City-Canyon	4.00	4,300	500	20	5
Sedwick	4.50	4,400	500	27	12
East Texas					
East Texas	1.35	3,600	450	6	
Woodlawn	4.25	6,600	575	32	24
Tennessee Colony	6.90	8,900	765		
Texas Panhandle					
Hugoton	3.25	3,200	500	8½	
Texas Gulf Coast					
Baison	3.80	8,000			
East Bay City	4.90	10,500			
East Riverside	2.85	5,500			
Fulton Beach	5-6.25	7,300	1175-1400 (barge)	21	
Hammaan	5.25	11,500	850		
Hull	4.95-5.10	9,400	650	27	3
North Karon	3.70	8,500	600		
Sour Lake	3.25	6,000			
South Houston	2.75	5,500			
South Mayersville	5.50	9,500			
Spindletop	3.25	7,100			
West Beaumont	3.40	6,500	675		
Columbus	4.90	10,000	744		
East Village Mills	2.95	7,300	682		
New Ulm	4.50	10,500	765		
South Liberty	4.25	7,500	720		
Glist	3.25	7,500	720	22	2
West Pheasant	5.45	9,500	775		
Lake Creek	4.95	10,000	720	40	
Hope	3.80	8,000	572	30	20
Brace	4.50	9,700	720		
Fulshear (No. Katy)	3.50	9,000	650		
Settegast	3.25	7,500	650		
Kuhlman	3.50	8,500	600		
LOUISIANA—Gulf Coast					
Bayou Blue	4.35	7,000			
Iowa	3.75	7,000			
S. Cottonwood Creek	3.50	7,850	575		
Welsh	4.00	7,000	775		
North Louisiana					
Big Creek	3.00	2,900	500	9	2
Delcho	2.50	2,850	500	7	2
East Haynesville	9.25	10,700	725	126	
Pine Island	1.75	1,700	500	9	2
North Shongaloo	3.95	5,850	575	20	7
Shongaloo	8.75	10,600	725	167	27
Waskom	2.75	3,850	500	10	2

*Footage rate includes rigging up and dismantling, drilling, fishing, W.O.C., downtime. Contractor usually furnishes fuel and water, and owner furnishes mud, but there are exceptions in some specific fields.

Field—	Footage Price*	Contract depth Ft.	Day work Rate	Total Footage	Days Day work
NEW MEXICO— San Juan basin					
Blanco	5.00	3,800	600	22	18
Kutz Canyon	3.50	2,300			
Denton, Lea County, (Devon.)	8.50	to 9,500	900-1000	55 to 9500'	110 to 12,500'
South Mattix	8.50	7,500	725	42	82
House	6.50	7,100			
House-San Andres	4.00	4,500			
CENTRAL OKLAHOMA					
Coffee Creek	5-5.50	6,200	650		
Seminole (Penn. sand)	3.25-3.50	3,450	480		
South Parks	4.00	5,000	480		
Witcher	4.75-5.00	6,400	500		
WESTERN OKLAHOMA					
Rich Valley Southeast Grant County	6.50	6,000	650		
Roger Mills County	9.00	13,500			
KANSAS					
Bushong	4.25	3,200	500	18	6
East Kansas (El Dorado, etc.)	2.75	2,000	480		
Hugoton	3.00	2,800	500	8	
Jelinek	3.50	3,500	500	20	5
Nemaha County	3.50	3,500	480		
Wabaunsee County	3.50	3,500	480		
W. Kansas (Arbuckle)	3.25	3,350-4,000	400	16	1
ARKANSAS					
Magnolia, etc., (Smackover lime)	3.75	7,000	600		
	4.50	7,000	600		
ILLINOIS-INDIANA-KENTUCKY					
General areas	3.25 to 4.00	3,800			
ROCKY MOUNTAIN					
Colorado—Mesaverde	6.75	2,350	625	35	19
Denver-Julesburg area	3.50 to 4.00	5,000	675		
Nebraska—Harrisburg	4.50	6,000	600	20	7
Wyoming—Sussex	5.50 to 6.50	7,700	725		
Slick Creek	10.25	10,400	900		
SOUTHERN OKLAHOMA					
East Velma	7.75	5,200	575	40	9
Fox-Shallow	3.75	4,400	500		
Fox-Deep	7.00	6,500	575	56	1
Golden Lane area: Deese-Hart	5-5.50	7,800	650	36	3
Ordovician	11.00	10,000	880		
Manika-Ring Unit	10.75	11,000	950		
Noble pool (McClain County)	8.75	9,000	700		
North Alma	5.50	5,700	575	39	1
Northeast Roady	4.75	4,600	500	22	
Sholem Alechem	5.75	5,900	600	30	5
Southeast Macomb	3.75	4,600	500	26	2
Velma	5.00	4,500	650	53	4
MISSISSIPPI					
Glen Aubin	3.50	7,500	575	36	9
Kingston	3.00	6,800	575	20	2
MICHIGAN					
Kawkawlin (Cable)	2.85	2,900	180		
Oceana County	3.25-3.75	1,800	400		
Stony Lake	300	1,600	200 (Cable)		
Pentwater	3.00	1,600 to 2,000	200 (Cable)		
WESTERN CANADA—Alberta					
Big Valley	5.75	5,400	744		
Redwater	4.50	3,300	744		
Stettler	5.75	5,400	744		
CALIFORNIA—San Joaquin Valley area:					
Edison area	6.00	6,400	800	27	3
Russell Ranch	5.40	3,500	720	13	2
South Cuyama	5.40	4,500	720	18	2
Coastal California					
Cat Canyon, deep	6.20	5,600	750	25	5
Cat Canyon, shallow	4.00	3,000	725	12	5
San Ardo	4.00	2,100	700	6	2
Ventura, D-6 & 7 zones	12.50	11,500	925	75	8
Ventura, D-5 zone	9.00	6,700	800	40	5
Los Angeles region					
Brea-Olinda	7.00	5,300	800	30	3
Del Valle	9.00	6,750	875	41	9
Long Beach	5.10	3,500	750	18	2
Placerita Canyon	4.00	2,000	700	6	2
Wilmington	4.25	3,800	800	23	7

every area where we operate, we're going to wake up and find ourselves out of business."

Quote 4.—"Demand for our rigs is at an all-time high and we are plenty busy, but the prices we are receiving for our work are entirely too low; we're not making enough money to justify our operational expenses."

Quote 5.—"In our opinion during the past year only a few drilling-contracting firms actually made money, and their profits were so small they were negligible."

Most reports received by the Journal from rotary-drilling contractors emphasized that the only way for them successfully to operate is to charge higher prices to help offset the rapidly rising costs, which would enable them to obtain a fair profit on their investments.

Today the nation is gearing for defense and again petroleum and its products are of utmost importance to the program. Crude-oil production this year almost periodically has been hitting new highs. Virtually all oil companies are expanding their exploratory and development efforts. The drilling industry is cutting more footage than ever before. But the rotary-drilling contractor, in order to "come into his own," says that he must get better prices.

Pricing conditions. — Conditions of price—footage and day work—overall today are the nub of the contractors' problem in the drilling business. Most all oil and gas companies that let contracts have established firm policies that they want the drilling contractors to do their work. And the drilling contractors in return are constantly and aggressively striving to reduce drilling time so that the net results turn up to the well owners in the way of economical drilling prices.

Individualistic business. — The rotary-contract driller, perhaps more than any other business man, is an individual. Each thinks differently, acts differently, and operates differently. Thus it is practically impossible to arrive at any definite average on prices.

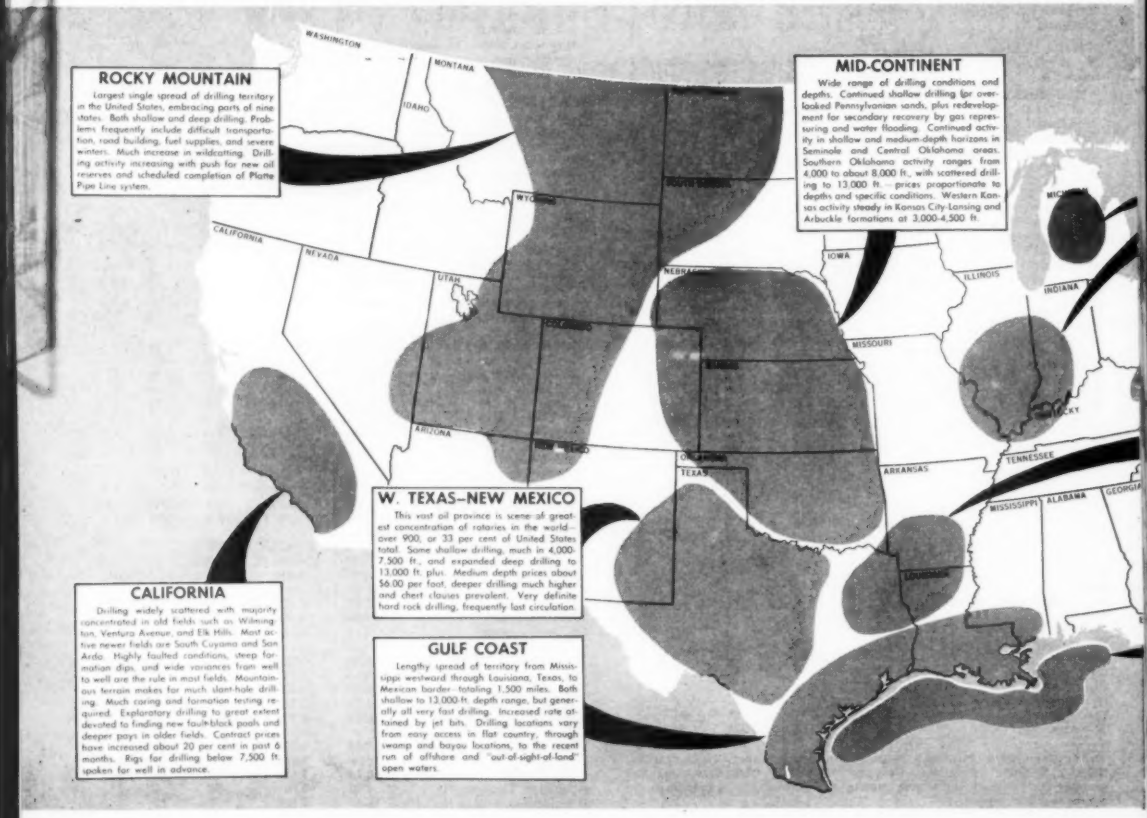
For instance, due to the more advantageous location of his rig, one contractor can or will do a job cheaper than another in one location, while at same time contractor who does job cheaper in that area would have to charge more than the other fellow on the next location.

"We can take a job at $6.25 per foot on one location and lose money," a contractor reports. "But Joe Blow across the road can or will drill the same well at $5.75 per foot." (Another contractor told the Journal that in his opinion "Joe Blow would lose money, too.")

The accompanying map and tabulated drilling-contract prices are the results of this survey by The Oil and Gas Journal. These figures are based on a study of actual prices paid by many oil companies during the past 12 months, and were pretty much stable up until the beginning of June of this year when the increasing demand for rotary rigs, which led to a growing shortage, changed the price-structure picture to some extent. This picture, however, has not changed the calculations of contractors to the point that increased costs would justify.

It is emphasized that while intensive efforts were made to obtain average "going" prices, in some cases the

Journal Map Showing Current Drilling Situation Throughout


ROCKY MOUNTAIN
Largest single spread of drilling territory in the United States, embracing parts of nine states. Both shallow and deep drilling. Problems frequently include difficult transportation, road building, fuel supplies, and severe winters. Much increase in wildcatting. Drilling activity increasing with push for new oil reserves and scheduled completion of Platte Pipe Line system.
MID-CONTINENT
Wide range of drilling conditions and depths. Continued shallow drilling (or overlooked Pennsylvanian sands, plus redevelopment for secondary recovery by gas repressuring and water flooding. Continued activity in shallow and medium-depth horizons in Seminole and Central Oklahoma areas. Southern Oklahoma activity ranges from 4,000 to about 8,000 ft., with scattered drilling to 13,000 ft. — prices proportionate to depths and specific conditions. Western Kansas activity steady in Kansas City-Lansing and Arbuckle formations at 3,000-4,500 ft.
W. TEXAS–NEW MEXICO
This vast oil province is scene of greatest concentration of rotaries in the world — over 900, or 33 per cent of United States total. Some shallow drilling, much in 4,000-7,500 ft., and expanded deep drilling to 13,000 ft. plus. Medium depth prices about $6.00 per foot, deeper drilling much higher and chert clauses prevalent. Very definite hard rock drilling, frequently fast circulation.
CALIFORNIA
Drilling widely scattered with majority concentrated in old fields such as Wilmington, Ventura Avenue, and Elk Hills. Most active newer fields are South Cuyama and San Ardo. Highly faulted conditions, steep formation dips, and wide variances from well to well are the rule in most fields. Mountainous terrain makes for much slant-hole drilling. Much coring and formation testing required. Exploratory drilling to great extent devoted to finding new fault-block pools and deeper pays in older fields. Contract prices have increased about 20 per cent in past 6 months. Rigs for drilling below 7,500 ft. spoken for well in advance.
GULF COAST
Lengthy spread of territory from Mississippi westward through Louisiana, Texas, to Mexican border totaling 1,500 miles. Both shallow to 13,000-ft. depth range, but generally all very fast drilling. Increased rate attained by jet bits. Drilling locations vary from easy access in flat country, through swamps and bayou locations, to the recent run of offshore and "out-of-sight-of-land" open waters.
WASHINGTON
MONTANA
IDAHO
WYO.
CALIFORNIA
NEVADA
UTAH
COLO.
NEBR.
IOWA
ILLINOIS
INDIANA
MISSOURI
KANSAS
OKLA.
ARIZONA
N. MEX.
TEXAS
ARKANSAS
TENNESSEE
MISS.
ALABAMA
GEORGIA
LOUISIANA

figures may be too low due to recent increases in costs of rig equipment, supplies, and labor. In certain cases, however, the prices may be too high, due to drilling-speed increases in fields where the contractors have become more accustomed to conditions and better able to cope with drilling problems or of drilling conditions. Also, figures are not given for many fields and areas where information was scanty or decidedly variant from drilling location to drilling location. No prices are given for wildcat drilling.

Last half of 1951.—Drilling operations will exceed the previous half-year record set during the last 6 months of 1950, according to the Journal's recent drilling survey. Old records will fall as operators foresee 23,863 wells drilled in the last half of 1951.

The forecast for the last half includes 5,523 wildcats and 18,340 development wells, or a total of 23,863, compared with 23,063 for all wells in the last half of 1950. This gain of 800 wells represents an increase of 834 wildcat wells and a small decrease of 34 development wells.

The relatively large gain forecast for footage compared with the increase in number of wells indicates deeper drilling than in the last 6 months of 1950. The depth of the average well in the forecast for the last half is 3,834 ft., or 251 ft. deeper than the average for the same period last year. This trend toward deeper wells is due both to deeper drilling in some of the areas and to a shift toward a higher percentage of completions in those states and areas where deeper drilling is common.

Good background.—Total completions for the first 6 months numbered 23,632, a gain of 416 wells or 2.1 per cent over the first half of 1950. Footage drilled totaled 79,732,958, a jump of 5,163,247 ft. or 6.9 per cent over last year. Both of these figures represent new all-time highs for comparable periods of any year in the history of the oil industry.

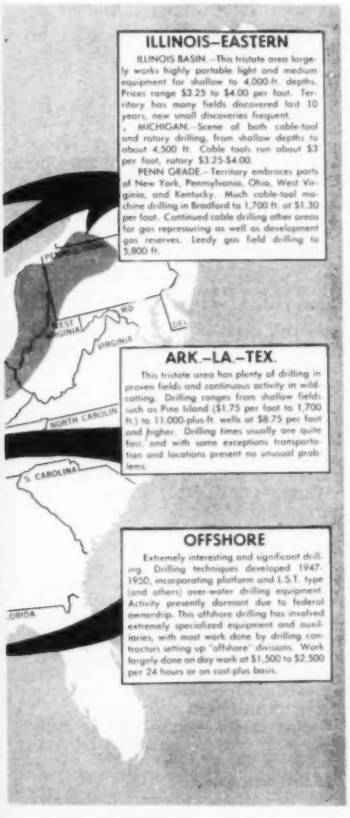
Significantly, in January 1951, operators reported to the Journal that they planned to complete more new wells during this year than ever before, and if they continue to drill at this midyear record rate, there is every indication that the tremendous program scheduled for 1951 will be fulfilled.

Two reasons stand out as bases for the increase in activity to supply the strong demand for all products: The unheard-of pace of exploratory ventures with emphasis on rank wildcatting, and accelerated work in many deeper already-established producing districts.

Every month for the first 6 months of this year saw a new all-time high in monthly crude-oil production established. From the record-breaking daily average of 5,907,000 bbl. in January, production of crude oil and condensate produced on leases in the United States steadily climbed to an average of 6,182,000 bbl. daily in June.

Right now every indication points to the greatest producing year in this country's history. If current forecasts based on these indications materialize, crude production will end up this year almost 13 per cent higher than 1950; and 10.5 per cent higher than the previous record year of 1948 when daily average production was 5,514,000 bbl.

United States


ILLINOIS–EASTERN
ILLINOIS BASIN.—This tristate area largely works highly portable light and medium equipment for shallow to 4,000-ft. depths. Prices range $3.25 to $4.00 per foot. Territory has many fields discovered last 10 years, new small discoveries frequent.
MICHIGAN.—Scene of both cable-tool and rotary drilling, from shallow depths to about 4,500 ft. Cable tools run about $3 per foot, rotary $3.25-$4.00.
PENN GRADE.—Territory embraces parts of New York, Pennsylvania, Ohio, West Virginia, and Kentucky. Much cable-tool machine drilling in Bradford to 1,700 ft. at $1.30 per foot. Continued cable drilling other areas for gas repressuring as well as development gas reserves. Leedy gas field drilling to 5,800 ft.
ARK.–LA.–TEX.
This tristate area has plenty of drilling in proven fields and continuous activity in wildcatting. Drilling ranges from shallow fields such as Pine Island ($1.75 per foot to 1,700 ft.) to 11,000-plus-ft. wells at $8.75 per foot and higher. Drilling times usually are quite fast, and with some exceptions transportation and locations present no unusual problems.
OFFSHORE
Extremely interesting and significant drilling. Drilling techniques developed 1947-1950, incorporating platform and L.S.T. type (and others) over-water drilling equipment. Activity presently dormant due to federal ownership. This offshore drilling has involved extremely specialized equipment and auxiliaries, with most work done by drilling contractors setting up "offshore" divisions. Work largely done on day work at $1,500 to $2,500 per 24 hours or on cost-plus basis.
PENN.
WEST VIRGINIA
MD.
DEL.
VIRGINIA
NORTH CAROLINA
S. CAROLINA
FLORIDA

The balance between these two factors, of course, will be one of supply and demand. The important thing is that both will increase—(1) the drilling demand which already is very much in evidence, and (2) the supply, which will be represented by orders for additional field-drilling units.

Competition.—Rotary-drilling contracting is an intensely competitive industry. By and large it competes for contracts on two different bases, (1) offering to contract the location or locations at the lowest possible price per foot and the lowest day-work price, and (2) offering superior drilling machinery and advanced know-how to the location owner who wants the well drilled.

In many cases the location owner will carefully weigh both of these bases in letting the work. Definitely, he will be interested in obtaining his drilling work done at a fair and reasonable price, but just as definitely he wants to see to it that a good rig is used, with all its collective meaning of first-class equipment in the way of draw works, rotary prime movers, pumps, wire lines, and other machinery necessary to insure that the well will be drilled in a speedy and workmanlike manner.

In the past, many times the rotary-drilling-contracting business has been one of "up awhile, down awhile." Those days sometimes were weary and tortuous, with contracts being bid for without proper attention to actual operating cost and rig-depreciation figures. Every excuse was offered and rationalized to keep a rig from being stacked.

And true, likewise there were days when big booms were on, that drilling prices rose rapidly for a short time and above normal levels. But the up-and-down times were not helpful to the oil-well-drilling industry nor to the oil-ond-gas-producing business in general. This was because the very nature of those pendulum-like swings likewise resulted in similar variations in the availability of good rigs and real operating know-how, both below and above normal and proper circumstances and efficient levels.

Drilling Is Competitive Industry

If rigs now are scarce and footage and day-work prices already are mounting, here and there, what is the future outlook? The answer to this is twofold: (1) footage and day-work prices now going up will gradually level off on a higher plateau; (2) more new rigs will be purchased and the industry will enter into a long-time higher level of "rigs running" and higher amounts of footage cut per year, if the drilling contractor can anticipate a reasonable return on his investment.

California

The wide variance of provisions in drilling contracts being written, coupled with the wide variance of conditions in California fields, make "average prices" absolutely meaningless. Since the first of the year there has been about a 20 per cent improvement in prices. Though rigs of the 2,000-ft. variety are fairly plentiful, those capable of drilling below 7,500 ft. are hard to get.

In general, about 90 per cent or more of the rigs available are being kept constantly at work.

Progress at a price.—The Journal's West Coast district editor reports that while contractors have done an excellent job of holding, or even reducing, footage prices, in so doing they may have been penalizing them-

selves in some respects. As one California contractor pointed out, the average daily wages being paid truck drivers, welders, and most semiskilled labor no longer are equal as to attract the highest-caliber workmen. This shortcoming is further borne out by the fact the industry has been unable to attract but few college-trained engineers; most feel the hardships are not worth the pay.

Until some 10 years ago—before "war-workers" became such a commonplace term—the wages being paid drilling crews were well ahead of any they could obtain elsewhere. Since then, and during a period of rapidly rising prices, drilling has been highly competitive. To keep their rigs busy, contractors were forced to bid low. In so doing they usually did not include allowances for vacations and other benefits which labor unions have obtained for workers in most other industries. The natural result is a downgrading in the class of newcomers to the industry—at a time when drilling machinery was becoming more and more complex.

This situation, in the contractor's opinion, is one of the most serious facing the drilling-contracting industry. His solution: With fewer rigs stacked, contractors should start including allowances for vacations and other benefits in their bids. The oil companies for whom the contractors drill, he feels, should be required to pay the some $10 or $15 per rig per day needed to provide these benefits. For, as he pointed out, both groups in the long run would benefit.

Gulf Coast

The Journal's district editors in the Gulf Coast area report that their survey reveals there is no shortage in rigs and equipment on the upper Gulf Coast, and no noticeable increase in prices for drilling. However, as one contractor reported, a very good percentage of the drilling equipment is in operation.

"But, working for all the major oil companies as we do," he said, "I know of no single instance where anyone has had any trouble getting a rig to do a given job. We are bidding on more and more wells than any time in the past year."

Other comments from Gulf Coast contractors were:

"All of our rigs are in operation, but we are still drilling for the same prices as a year ago."

"I believe there is a rig shortage on the lower Gulf Coast — particularly barge rigs. The flurry of activity in the bays would account for this. There is very little, if any, difference in today's prices compared with those of a year ago. If there is a rise in the drilling contractors' prices, it will be due to the fact that all other prices are rising."

"There doesn't seem to be any shortage of rigs at the present. However, there is more activity now, and it looks as if the stepped-up activity will continue, which might account for a shortage. We are still drilling for the same prices as a year ago."

Basis Is Unit Cost

The basis of successful and economical contract rotary drilling is founded on daily costs. When a rotary rig is in operation it has certain very definite unit costs each 24 hours. All contractors are familiar with these costs. Basically, there are four main items: (1) overhead, (2) labor, (3) operating expense, and (4) rig and drill pipe depreciation.

Overhead.—This daily cost factor includes general and field-office salaries and expense, yard and camp expense, tool-pusher wages and expenses, and ad valorem taxes.

Labor.—This item includes the rig-crew labor, workmen's-compensation and public-liability insurance, and Social Security taxes. Most rotary rigs use a five-man crew although certain deep operations and specialized drilling necessitate a six-man-crew setup.

Given below are cost figures for labor, compensation and insurance, and payroll taxes which collectively total the "labor" item above, as prevalent for certain contractors operating in a spread of territory embracing nine states. The tabulations are for the average cost both of five-man crew and six-man crew rotary-rig setups.

LABOR, INSURANCE AND TAXES, PER DAY
(Based on 56 hours per man per week)

	Average labor cost	Compensation and insurance per $100 payroll	Payroll taxes	Total
Avg. cost per five-man crew:				
Texas	$231.50	$12.16	$ 4.86	$248.52
Louisiana	231.50	10.21	8.33	250.04
Mississippi	231.50	10.66	8.33	250.49
Oklahoma	231.50	15.23	6.25	252.98
New Mexico	231.50	16.65	4.86	253.01
Wyoming	235.94	3.15	4.95	244.04
Utah	235.94	7.99	10.62	254.55
Nebraska	235.94	8.58	10.62	255.14
North Dakota	235.94	9.58	10.62	256.14
Avg. cost per six-man crew:				
Texas	273.87	14.45	5.75	294.07
Louisiana	273.87	12.13	9.86	295.86
Mississippi	273.87	12.67	9.86	296.40
Oklahoma	273.87	18.11	7.39	299.37
New Mexico	273.87	19.79	5.75	299.41
Wyoming	278.40	3.73	5.85	287.98
Utah	278.40	9.77	12.53	300.70
Nebraska	278.40	10.49	12.53	301.42
North Dakota	278.40	11.71	12.53	302.64

Operating expense.—This factor also sometimes is termed "rig maintenance and supplies"—included here are rig repairs, supplies, oil, grease, and wireline expense.

Rig depreciation.—Various depreciation methods may be used. One realistic view is based on a total life of 1,500 operating days. Another is total life of 1,095 operating days coupled with 10 per cent salvage value. Drill pipe, derrick, or mast are not included here.

Other Operating Costs

Besides the above factors, other factors entering into rotary-rig operating costs are as follows:

Drill pipe.—One method of computing drill-pipe expense per day may be accomplished by adding the maximum amount of pipe used in the well in each 24-hour day during drilling period, then dividing by the total number of days the pipe is used and multiplying the result by applicable footage rate.

The footage rate may be such as:

	Rate per ft. per 24-hour day
3½-in. drill pipe	$0.01 to 0.015
4½-in. drill pipe	0.015 to 0.0175
5⅞-in. drill pipe	0.02

Naturally, these figures should be set up on actual experience and drill-pipe performance for the contract areas and territories involved.

Derricks and masts.—Often operating costs for derricks or masts are set up as costs per day, based on actual experience and cost foundations. One schedule is as follows:

Derricks and substructure:
$10 per day for 82, 92, and 122-ft. derricks
$12.50 per day for 129-ft. derrick
$15.00 per day for 136-ft. derrick
Masts:
$12.50 per day for 122-ft. masts
$15.00 per day for 129-ft. masts
$20.00 per day for 136-ft. masts

Derrick erection and dismantling.—Figure will depend on current charges by rig-building contractors, or crew costs for the contractor.

Drilling bits and reamers. — These are determined by individual conditions in the field or area applicable.

Fuel.—Costs are determined by sources and prices in the specific area.

Water. — Costs are determined by sources and prices in the area.

Fuel and water lines.—Contractor figures costs applicable to actual location.

Trucking.—Can often be a sizable cost figure. Item involves cost of moving or skidding of rig to location plus incidental trucking expense during drilling of the well.

Pits.—Cost determined in excavating earthen mud pits at the drilling site, or furnishing steel pits.

Casing crews.—Actual casing crew expense as will be sustained by contractor.

Miscellaneous.—Costs that will very likely be sustained by contractor dur-

OIL AND GAS COMPANIES: PRESENT RANGE OF ROTARY CONTRACTS SIGNED ON DAY WORK RATES

Contract depth:	0-4,000 ft.	4,001-7,000 ft.	7,001-9,000 ft.	9,001-11,500 ft.	11,501-13,500 ft.
Rate between:	0-4,000	0-7,000	0-9,000	0-11,500	0-13,500
Low	$400	$500	$550	$650	$750
High	500	850	900	950	1,200

DRILLING CONTRACTORS: AVERAGE ACTUAL COSTS FOR ONE GROUP
(Drill-pipe depreciation not included. Profit margin not included.)

Rig range—	0-4,000 ft.	0-7,000 ft.	0-9,000 ft.	0-11,500 ft.	0-13,500 ft.
Overhead*	$75	$80	$85	$90	$95
Labor*	†215	260	260	260	260
Oper. exp.*	115	150	175	200	210
Rig. deprec.*	45	70	100	150	195
Total	$450	$560	$620	$700	$760

*See above discussion for details of items included in these headings; bits, fuels, water not included. †Four-man crew.

ing the drilling operation not otherwise provided for.

Unit Costs, Contractors vs. Owners

The bidding and letting of rotary-drilling contracts is a competitive business between drilling firms on one side, and the oil and gas companies (location owners) on the other. As previously mentioned, price is one factor and the use of superior drilling machinery and advanced know-how is another factor. Very definitely, the contractor's pencils are sharp in framing bids that are realistic as to the actual figures plus reasonable profit, and the oil companies' eyes are alert to the use of good-quality drilling equipment and trained personnel.

There is a spread between what the drilling contractors think prices should be, particularly with mounting equipment and labor costs, and sometimes the company owners are slow to be cognizant of these increases in operating costs. The going spread in contract-price thinking between the two types of parties is larger today than it was 90 days ago, particularly today when virtually all available rigs are being operated at capacity. To illustrate what this difference or spread in price thinking is today, the following unit-daily prices were obtained by The Oil and Gas Journal, from a number of contractors on the one hand and oil and gas companies (well owners) on the other.

Today's current costs of representative rotary rigs complete with blowout equipment but less drill pipe and derricks or masts, require very substantial investments. A study by the Journal of a number of complete rotary-rig outfits as defined above, with different drilling-depth ranges, is shown in the following table. This table also displays the daily depreciation rate figure on two different bases.

ROTARY RIG INVESTMENT AND DEPRECIATION RATES

	Tot. rig cost complete (less derrick)*	Daily deprec. rate: 1,500 oper. days (20% salvage)	Daily deprec. rate: 2,250 oper. days (no salvage)
0- 4,000 ft.	$85,000	$46.00	$38.00
0- 7,000 ft.	135,000	71.00	59.00
0- 9,000 ft.	190,000	101.00	84.00
0-11,500 ft.	290,000	153.00	128.00
0-13,500 ft.	365,000	194.00	162.00

*Drill pipe and collars not included.

The actual costs on these rigs, it will be noted, range from $85,000 to $356,000 and corresponding daily depreciation rates range from $38.00 and $46.00 (two bases, 0-4,000 rig) to daily depreciation rates of $194.00 and $162.00 for rigs capable of depths of 13,500 ft. or more.

Contractors' Profits?

Financial statements of 27 drilling firms operating 57 rigs show profit margin of only 2.68 per cent

THE STUDY.—What are the financial facts as to the earnings of rotary-drilling contractors on their investments?

To find out, an actual study was made of the "books" for a number of drilling firms. Standardized forms were made up for this purpose and a representative group of drilling contractors consented to participate. The compilations of financial data were tabulated by a certified public-accountancy firm in Tulsa.

The accounting firm took the investment and operating cost figures from the standardized forms and put the figures on adding machines to work out average figures for cost of operations, and income. Four classes were involved, "light," "medium," "heavy," and "extra heavy," for the 57 rigs which covered drilling operations in Oklahoma by the total of 27 contractors.

The financial analysis made was stated in this form:

THE RESULTS. — (Statement by (C.P.A. firm).—"On the basis of questionnaires received from oil-well-drilling contractors representing 57 rigs, we have compiled various points of statistical information which may be of value to the contractors involved.

"It must be remembered that the companies reporting were not identified by name nor by type of organization, i.e., corporation, partnership, or proprietorships, which would bear on overhead expenses. It is also a certainty that the companies reporting are not consistent in the treatment of expenses nor of capital items. Some items of expense may be handled as direct drilling expense by one company and as overhead by another. Bearing the above inconsistencies and difficulties in mind, we submit the following information.

"Out of the 27 reports which we received, 13 showed a loss of $367,721.95 on their operations for their last completed accounting year. On the other 14 the profit shown was $482,309.90, with 3 reports showing over one-half of the profit. This net profit of $114,587.95 amounts to only 2.68 per cent of the total residual cost of rigs, drill stem, and facilities of $4,283,274.82.

"The replacement cost of rigs was shown to be approximately 1¾ times as great as the residual cost of $3,495,856.28. Assuming that the replacement cost of the drill stem is the same as its residual value, the net return of the replacement cost of rigs, drill stem, and facilities is only 1.58 per cent.

"To the extent that individual proprietorships or partnerships are included above, which would probably not have owners' salaries included in overhead, this is a very poor return on capital and individual effort.

"Following is a table setting out average costs of operations and income therefrom as reported:

AVERAGE COSTS OF OPERATIONS AND INCOME

	Rigs: Light	Medium	Heavy	Extra heavy
Direct drilling expense per foot drilled	$3.69	$4.40	$5.88	$6.48
Indirect expense per foot drilled	1.13	1.16	1.75	2.31
Total	$4.82	$5.56	$7.63	$8.79
Total drilling cost per payroll day	$663.20	$720.16	$1,036.69	$825.92
Total drilling revenue (footage and day work) per payroll-day	617.85	746.38	1,007.44	920.33
Daily day work revenue	555.26	505.72	754.78	795.51

DETAILED FINANCIAL ANALYSES OF 27 CONTRACTORS OPERATING 57 RIGS

	Light	Medium	Heavy	Extra heavy	
Number of rigs reported on	16	29	8	3	
Average cost per rig	$100,869.72	$ 98,585.45	$122,554.99	$175,659.12	
Average reserve for depreciation	54,637.28	48,575.94	57,631.26	82,677.48	
Average residual	46,232.46	50,309.52	64,923.72	92,981.63	
Average replacement cost	70,436.60	101,253.24	139,918.82	175,300.00	
Excess of replacement cost over book value	24,206.34	50,943.72	74,995.10	83,518.37	
Drill-stem averages per rig:					
Cost	24,563.04	31,373.28	40,419.90	67,128.00	3 rigs
Reserve for depreciation	14,526.97	18,295.68	14,868.58	29,193.20	3 rigs
Residual cost	10,041.07	13,077.59	25,551.02	37,934.70	3 rigs
Total facilities (autos, trucks, bldgs., etc.), average per rig owned:					
Cost	6,206.64	7,636.02	5,013.59	18,213.27	3 rigs
Reserve for depreciation	2,898.92	2,656.39	1,660.58	6,063.93	3 rigs
Residual	3,307.72	4,979.64	3,353.01	12,149.34	3 rigs
Replacement cost	5,301.14	7,581.68	5,585.24	21,545.99	3 rigs
Average working capital per rig	44,173.74	56,001.16	64,303.84	115,837.38	3 rigs
Average working capital per $ of total drilling costs	.3433	.3239	.3099	.5360	3 rigs
Average direct drilling expense per foot drilled	$ 3.686	$ 4.2965	$ 5.8769	$ 6.4825	
Average indirect expense per foot drilled	1.123	1.169	1.754	2.3102	
Total drilling cost per payroll day	663.20	720.16	1,036.69	825.92	
Average drilling revenue per payroll day	$ 617.85	$ 746.38	$1,007.44	$ 920.33	
Average amount of footage revenue per foot drilled	$ 4.127	5.047	5.647	8.573	
Amount of total drilling revenue per dollar of rig & drill stem investment:					
Cost	$ .9555	$ 1.3547	$ 1.2371	$ 1.1642	
Residual	2.1299	2.7839	2.2284	2.1772	
Amount of total drilling revenue per dollar of all investment (rig, drill stem and facilities):					
Cost	$ .9105	$ 1.2797	$ 1.2002	$ 1.1079	
Residual	2.0117	2.5811	2.1483	2.0476	

"To the extent that the above figures are accurate it would seem that the rates charged by the industry at the present are entirely inadequate to give a fair return on capital.

"Further details of this study of drilling contractors' financial books are shown in the accompanying large table."

INDUSTRY REPORT

A Growing Business

Contract drillers now operating 90 per cent of all the rotary rigs in U. S.; percentage of wells drilled rising

CURRENTLY contract drillers are operating nearly 90 per cent of all rotary rigs in the United States, according to A. W. Thompson, Thompson-Carr, Inc., Houston, president of American Association of Oilwell Drilling Contractors. Total active rigs are approximately 2,900 for United States and Canada.

The percentage of wells drilled under contract, Thompson reports, has increased steadily over the past 15 years, from about 68 per cent in 1935. This percentage has increased sharply in recent years as contractors received recognition for their ability to "make more hole at a lower cost."

It is estimated that total drilling costs today are approximately $12.00 per foot, or on the basis of 160,000,000 ft., about $1,920,000,000. Contractors will drill about 140,000,000 ft. of the total, for which they will receive an average price of about $6.00 per foot, or approximately $845,000,000.

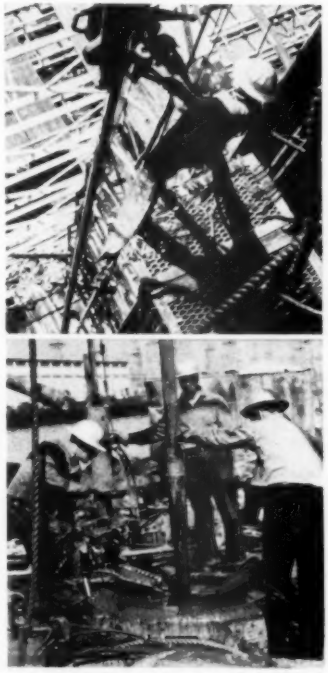
Manpower.—Manpower demands of the drilling industry, Thompson points out, on basis of 2,400 rotary rigs operating, such a number requires about 20 men each, or 44,800. The 1,200 cable-tool rigs require 7 men each, or 8,400, representing a total of 53,200 men (figure is now higher) for both types of rig.

Shortage of skilled manpower is a real worry among contract-drilling companies if mobilization continues at an accelerated pace.

Equipment needs.—Another problem faced by the drilling industry is the need for an adequate supply of high-quality equipment, including drill pipe and casing. As an example, Thompson reports, it is estimated that to drill 43,400 wells during 1951, approximately 666,000 rotary rock bits will be required, involving some 49,800 tons of steel. This steel requirement is only a part of the actual problem, as at least 75 per cent of the steel used in bits can be recovered and used again.

Thompson reports that the many pieces and types of equipment required by the drilling contractor to make hole efficiently are too many to enumerate; however, they require many materials in addition to those enumerated above which may be in short supply, including rubber hose, equipment parts, wire lines, chemicals for treating mud, etc.

At the close of World War II, the steel companies estimated that approximately 11.2 tons of steel were required to drill 1,000 ft. of hole; this includes casing, tubular goods, and drill pipe. It is estimated that this figure today is approximately 12 tons per 1,000 ft. of hole. On this basis it is indicated nearly 2,000,000 tons of steel will be required to drill 160,000,000 ft. of hole in 1951, he states.



Representative "manpower" scene on any rotary rig. Multiply this scene by about 2,900 and put on 24-hour basis for each day, to broaden the picture to equal the entire rotary-drilling industry.

Importance of safety on the derrick floor is recognized by Stanolind Oil & Gas Co. and this photograph shows drilling personnel at a regular company safety meeting.

Safety First!

To make it effective around the rig, finger must be put on the driller, backed up by management, A.A.O.D.C. says

BENEFITS of operating safe equipment are becoming more and more obvious to the oil-well drilling contractor, and it is the majority of opinion that the driller is the one who should have the responsibility of seeing that safety practices are carried out on the rig.

This is the consensus of members of A.A.O.D.C.'s safety clinic, a group which studies the latest safety methods.

In organizing its over-all program, the safety clinic reports that some disagreement was expressed about who is responsible for making a safety program function, and it was suggested that, first of all, top management in a drilling company must be convinced of the necessity of such a program. But safety men argue that this can be sold solely as a dollar-and-cents proposition, because of the savings of lost time, lowered insurance premiums, and a more efficient operation. And saving of lives and prevention of injuries make the program easier to sell and firmly establish.

Once top management is convinced that a safety program is desirable, the finger must be put on a key man at each rig to make it work—and that key man is the driller, who should be trained for this responsibility.

On the job.—The driller was picked because he is in constant attendance at the rig, knows the personalities and habits of all the men in his crew, and to some degree represents management, particularly when the tool pusher is absent.

But a successful safety program requires cooperation from the roughneck to the highest point in management, the clinic agrees, for this is necessary if operating practices are to be kept safe, and if proper equipment is to be made available to the roughneck.

Securing cooperation of the employe is one of the essentials of a successful safety program. This can best be done by building high morale among drilling crews, and can be accomplished by management's demonstration of sincere interest in the employe's safety and general welfare.

Hazards.—Existing equipment hazards are receiving severe scrutiny by the safety clinic. Many of these faults are being corrected in new machinery, but danger in bad features of older equipment that must remain in service must be minimized by proper maintenance and by proper instruction of drilling crews about the hazards involved and how to avoid or treat them.

Frequent safety meetings have been termed a "must" by the safety clinic, and everyone closely connected with the drilling operation should be required to attend them, the clinic suggests.

What to guard against.—Hunter Eakle, of Eakle & Holder Drilling Co., Carmi, Ill., chairman of the A.A.O.D.C. Tri-States safety committee, points out that with a safety organization, such hazards as the following can be guarded against:

1. Unguarded belts and moving machinery.
2. Grooved and worn out catheads.
3. Improper snub lines or no snub lines.
4. Improper precaution in taking drill-stem tests.
5. Worn and improper tools.
6. Working in the derricks without safety belts.
7. Riding elevators up and down to the double-board instead of climbing ladder.
8. Not shutting machinery down to make minor repairs and adjustments.
9. Improper handling of inflammable fuels, such as diesel, gasoline, and butane and natural gas.
10. Carelessness and lack of thought in doing a given job.

Safety committees, he said, should encourage and insist on:

1. Safe and proper training of inexperienced employes, explaining the hazards that exist, through unsafe conditions.
2. Proper clothing, safety hats and hard toe shoes.
3. Rig systems—good housekeeping.
4. Employe interest in safe procedure.
5. Interest in the safety of themselves and their fellow workers.

More Efficiency

Training aids in faster drilling, A.A.O.D.C. says

EFFICIENCY of the drilling industry has increased in the neighborhood of 45 per cent during the past educational program of the assodent of A.A.O.D.C. reports. This record can be attributed largely to the educational program of the association.

Thompson points out that the industry has had tremendous improvement in equipment in the past 10 years, but were it not for the trained personnel, this increase in efficiency in penetration rates would not have been achieved.

Those who have taken advantage of the association's educational programs have proved this point, Thompson reports. Training is reflected, he said, not only in the technological end of the work, but there is also developed an improved morale and attitude,

UNITED STATES ROTARY-DRILLING STATISTICS

Year	Men employed in rotary drilling	Average No. rotary rigs operating	Rotary footage drilled (million feet)	Rotary wells drilled	Average well depth
1945	33,418	1,705	63.03	18,027	3,489
1946	31,115	1,562	57.46	20,167	3,345
1947	35,437	1,806	78.05	23,224	3,404
1948	42,434	2,165	102.58	29,651	3,463
1949	39,396	2,010	110.32	31,005	3,558
1950	42,356	2,161	130.21	35,298	3,689

ROTARY-DRILLING PENETRATION DATA

Year	Wells drilled per average rig operating	Footage drilled per average rig operating	Yearly average ft. of hole per man employed	Ratio of men trained to men employed
1945	10.6	37,000	1,885	-
1946	12.9	43,150	2,165	.0206
1947	12.8	43,700	2,230	.0656
1948	13.7	47,400	2,420	.0460
1949	15.4	55,000	2,800	.0690
1950	16.3	60,300	3,080	.0766

EFFECT OF SUPERVISORY TRAINING ON INSURANCE COSTS

Company	Months in program in year 1949	1948 entire year per cent	Premium loss ratio 1949 Before entering program per cent	After entering program per cent
A	10	93.6	99.5	27.5
B	10	52.3	47.4	41.3
C	6	24.5	40.8	3.34
D	6	75.25	56.53	18.73

greater teamwork among the men, and an intangible quality of workmanship that leads to definite results—more and better footage of hole per dollar spent.

Statistics show, Thompson says, that the footage drilled per man and per rig has increased steadily and in about the same proportion as the increase in the association's training program.

Various training courses handled 642 men in 1946; 2,328 in 1947; 2,947 in 1948; 2,720 in 1949; 3,249 in 1950; and 77777 so far this year.

Types of courses.—The training courses include mud schools, accident-prevention conferences, management institute, drilling-engine courses, supervisory training, drilling-practice courses, and the new field institutes begun this year.

The programs cost $12,640 in 1946; $39,230 in 1947; $38,720 in 1948; $67,772 in 1949; $71,215 in 1950; and $36,919 to May 1 this year. Of the total expenditure of $266,496, $35,750 was supplied by A.A.O.D.C. funds, $78,476.50 came from state vocational funds, $132,962.50 from fees by industry, and $19,307 from other sources.

Thompson reports that the latest addition to the A.A.O.D.C. program is the new field institutes, which is a specialized type of supervisory training aimed at toolpushers and drilling superintendents, pinpointing specific drilling problems through use of well-prepared conferences.

Increases drilling.—The educational program is credited by Thompson in increasing the amount of drilling being done by contractors. He points out that 80 per cent of all wells drilled in the United States in 1945 were drilled by contractors, but that this percentage increased to 81 in 1946 and 1947, to 82 in 1948, to 85 in 1949, and to 89 in 1950.

The association's training program, Thompson reports, is directed to aiding both large and small contractors, but its value is attested by the fact that many oil companies have sent men to the courses and some of them have adopted the methods for their own organizations.

Latest educational project of the association is compilation of an illustrated booklet on oil-well-drilling terminology. Its publication will be primarily for office personnel, but may form the basis for a series of training meetings.

Lowers insurance rates.—An important result of the A.A.O.D.C. training program is the effect of supervisory training on insurance costs. Statistics prove that when a company enters a concentrated training program, its premium loss ratio drops appreciably. One firm which had a 93.5 per cent loss ratio during 1948, and which had a 99.5 per cent loss ratio in 1949 before entering the A.A.O.D.C. training program, reported that its premium-loss ratio after entering the program for the remainder of 1949 had dropped to 27.5 per cent.

Training example.—A. L. Franzolino, assistant professor of the personnel administration department of Southern Methodist University, Dallas, who analyzed results obtained by drilling contractors in the program sponsored by A.A.O.D.C. in conjunction with the university, reports that the general attitude of drilling contractors, toolpushers, drillers, and roughnecks toward the program was found to be "excellent."

When contractors were asked the question: "What tangible results do you feel that your company received from the training program?" the following replies were received:

"The men have a 'feeling of belonging'."

"We have the confidence of the men down to the lowest level."

"The men know what is expected of them."

"There is a feeling of pride for the company."

"We have reduced costs."

"We have reduced accidents."

"The men have a better understanding of their responsibilities."

"This program should have been started 24 years ago."

"We have decreased insurance rates."

"We have increased employe benefits."

"We have increased our efficiency."

"We have saved anywhere from $20 to $3,000 per rig."

"We feel that we are getting better men."

"We now have a vacation plan."

"We have saved $14,000 on claims."

"We have better relations."

Teamwork Pays Off

Too often those in authority ignore an employe's good work, but a little recognition is well worth the effort

THE management of many drilling firms often makes the mistake of taking its employes for granted—never complimenting them on their good work or giving them credit for new ideas, money-saving inventions, and the like—but study has shown that the little effort needed to give them the proper recognition is well worth while. It pays off in better cooperation, which results in better work and makes the employe feel that he is really a part of the organization.

This fact has been forcefully brought to the mind of the drilling-contracting industry by James E. Conway, assistant general superintendent in charge of personnel for Carl B. King Drilling Co., Midland, Tex., in his report to A.A.O.D.C. on mobilizing the powers of a drilling organization.

Conway reports that the answer to the question, "What is an organization?" is that one begins to exist when two or more persons get together to accomplish some definite end. It can be simple or it can become complicated, but teamwork is essential to success.

Practically all the people in the oil industry, Conway says, have grown up in one or another of its

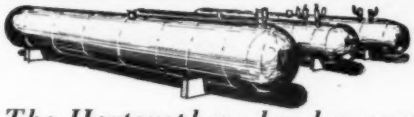
What's your *Pet Peeve* about Pressure* Storage?

- ✔ multiple fittings?
- ✔ painting costs?
- ✔ ground area?

the Hortonsphere eliminates all three because—

1. *The Hortonsphere has only one set of pipe connections and fittings*

Several cylindrical tanks with *multiple* fittings and pipe connections are needed to hold the *same* volume of liquid or gas contained in *one* Hortonsphere with *one* set of fittings and pipe connections. Not only does this mean a saving in equipment, but it means that a Hortonsphere requires less inspection and costly maintenance.



2. *The Hortonsphere has less surface area per barrel of capacity than any other container*

A 30-ft. diam. Hortonsphere has 2,827 sq. ft. of surface area and a volume of 2,518 U.S. bbls. For the same volume, you could use three horizontal tanks, each 9 ft. round by 77 ft. long—but the surface area of these tanks would be 6,540 sq. ft.! Since the Hortonsphere has less surface area, it costs less to paint and to insulate.

3. *The Hortonsphere requires less ground area*

The figures at the right show how a Hortonsphere requires less ground area. This is an important consideration where land values are high and space is at a premium.

**Pressure storage refers to the type of storage used for light hydrocarbons like natural gasoline and butane.*

Comparative Ground Area

Hortonsphere — A 30-ft. diam. Hortonsphere has a capacity of 2,518 U.S. bbls. and requires a foundation that covers 1,250 sq. ft. of ground area.

Horizontal cylindrical tanks. To get the same capacity, you would need three tanks 9 ft. in diam. by 77 ft. long whose foundations would cover 3,080 sq. ft.

These figures deal only with ground area for foundations. To get the total ground area needed, you would have to allow for spacing from property lines and other structures. This spacing is usually different for each installation.

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Detroit, 26.....1514 Lafayette Bldg.
Houston, 2.....2119 National Standard Bldg.
Los Angeles, 17.....1523 General Petroleum Bldg.
New York, 6.....3347—165 Broadway Bldg.
Philadelphia, 3...1615—1700 Walnut Street Bldg.
Salt Lake City, 4.....525 West 17th South St.
San Francisco, 4.....1554—200 Bush St.
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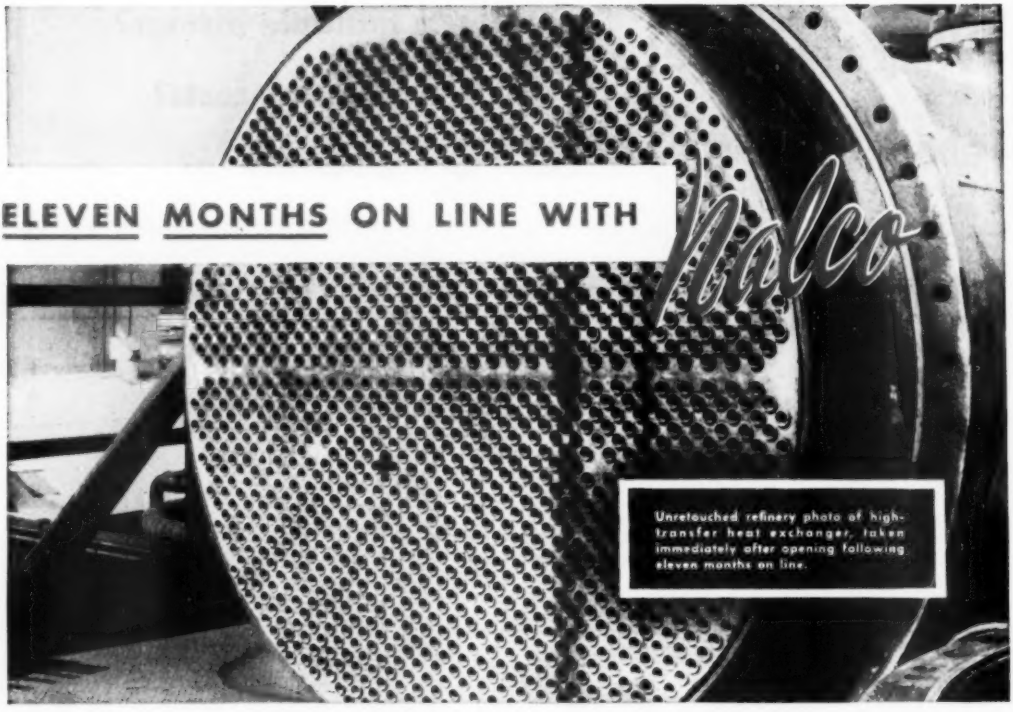

Unretouched refinery photo of high-transfer heat exchanger, taken immediately after opening following eleven months on line.

...and clean as the day it started!

This heat exchanger was labeled the most troublesome unit in the refinery from a standpoint of scaling and corrosion before the Nalco No. 33 Method of recirculating cooling water treatment was put in operation. Now, routine inspections show tubes that are always so clean that no cleaning or tube replacements due to water side scaling or corrosion have been necessary during three years of Nalco System use!

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phases, and many of the men who pioneered it are still active. Daily, men are coming from the rank and file to fill top positions.

Self-respect.—There exists in every man certain basic needs: Self-respect, and the need to be needed, Conway claims.

In self-respect, a man paints within himself a portrait of what he desires and what he wants, and in this picture the man places those things he wants, and avoids all that he thinks will harm or mar his picture.

The man does not think himself indispensable in his need to be needed, but he thinks that he needs recognition.

Here are a few illustrations to bring out the importance of recognition to individuals:

Case 1.—A geologist leaves word at a drilling rig that samples are to be caught every 10 ft. The rig men are careful to see that his orders are carried out, to the letter. One day along comes Mr. Geologist, who looks over the pile of samples, selects about four or five, and then, before the very eyes of the men who have been so diligent in collecting all these samples, throws the rest away. Imagine the samples this geologist will get on his next job with this crew. Imagine the deflated ego, the crushed self-respect of the crew.

Care 2.—A drilling engineer comes out to the rig, looks down his intelligent nose at the crew men, gives his orders, and is gone or checks on something he has ordered done and goes his way. That engineer leaves behind him a group of men into whose hearts he has implanted the seed of hatred. Why? He has given these men the impression that they are not needed. He has unconsciously forgotten to recognize the work which these men have done. These men may be trained specialists, but they are specialists who do not know men. They at best need a course in knowing and understanding people.

Case 3.—A small drilling company contemplated hiring a conference leader. There were those who hesitated until a count was taken on the years of experience the company had at its disposal and was failing to utilize. There was in that small company alone about 3,000 years of experience. Immediately it was apparent to the officials that could they line up this experience beside their equipment, they would be hard to beat.

Within a year the company took on a full-time conference leader. Today after a relatively short period of time, improvements are beginning to show all along the line. The amount of work produced is greater and more efficient. The morale among the company's people is higher.

The walls that separated the top people from the field personnel, and vice versa, are slowly being torn down. An adequate system of communication is being established, policies are being formed, methods devised. And who is doing it? The united experience of the people who make up that organization.

It becomes apparent, Conway points out, that once the experience or brain power of the oil industry begins to march side by side with the power of equipment, there will be no industry that will have a greater efficiency, a higher morale, a more singleness of purpose than the oil industry.

This can happen, but only if and when the top men in the industry begin to see and use the vast store of power there is in the united experience or brain power of the oil industry, he reports.

RESEARCH

Drilling Research, Inc.

This nonprofit organization devotes its time in search of ways and means to cut the cost of contract drilling

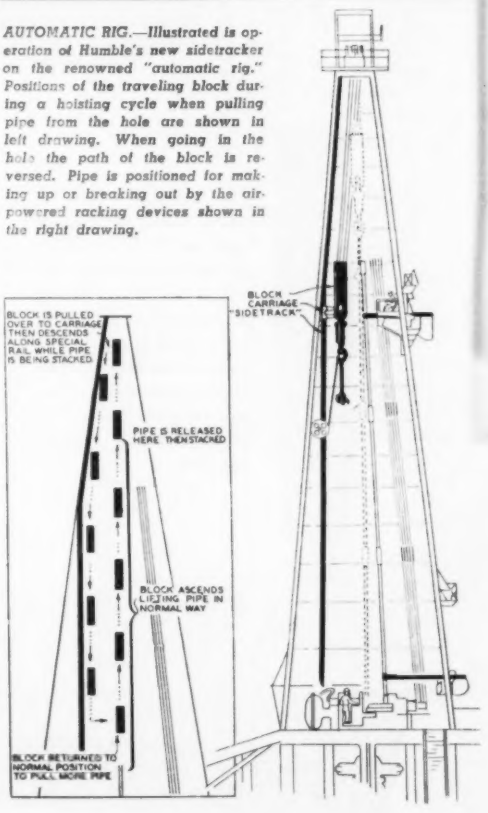
GENERAL objective of Drilling Research, Inc., a nonprofit organization headquartered in Houston, is to find ways and means of trimming the costs of drilling, which, in the face of rising prices which have increased capital investments required to drill a well, are threatening to make the job impractical and commercially unfeasible.

Within the scope of its objective, the group has taken as its immediate concern the investigation of "unconventional" drilling methods—or, methods differing from the conventional in their essential principles.

J. V. Pennington, technical director of D.R.I., reports that while there are many in the industry who hold the view that research effort should be directed toward improvement of present rotary practices, there is also the view that, while it may in the last analysis be necessary to confine the research to improvement of present practices, there remains as of this moment the possibility that a basically different and more economical method could be found.

Three phases.—The program of D.R.I. up to the present consists of three phases, two of which were accomplished during the last year, and the third of which is still in progress.

The first phase consisted of a search of the technical and scientific literature and of the domestic and foreign patent files for all the ways of drilling or of disintegrating rock-like materials that had been employed or suggested, and for all engineering and scientific principles that might


BLOCK IS PULLED OVER TO CARRIAGE THEN DESCENDS ALONG SPECIAL RAIL WHILE PIPE IS BEING STACKED
PIPE IS RELEASED HERE THEN STACKED
BLOCK ASCENDS LIFTING PIPE IN NORMAL WAY
BLOCK RETURNED TO NORMAL POSITION TO PULL MORE PIPE
BLOCK CARRIAGE "SIDETRACK"

AUTOMATIC RIG.—Illustrated is operation of Humble's new sidetracker on the renowned "automatic rig." Positions of the traveling block during a hoisting cycle when pulling pipe from the hole are shown in left drawing. When going in the hole the path of the block is reversed. Pipe is positioned for making up or breaking out by the air-powered racking devices shown in the right drawing.

DRILLING CONTRACTORS and BAKER Always Have Worked Together

Baker men are no strangers to the needs of Drilling Contractors. Dozens of times each day the SERVICE DIVISION of Baker Oil Tools, Inc. solves a wide variety of the same problems that confront you as a contractor, by recommending use of the products pictured here. These tools have been developed, tested and perfected by Baker, working hand-in-hand with contractors to provide the same tools you would build if you were in our place. They will make your operations easier, faster, safer—and result in better wells with greater production.

For a "sure-fire" shut-off use this Baker Casing Bridge Plug (Product No. 400-D) which can be run and set either on tubing or a *wire line*. ★ For squeeze cementing, acidizing or testing, use the old reliable Baker Cement Retainer, Product No. 400.

The Baker Retainer Production Packer (Product No. 415-D) meets most production requirements with unequalled flexibility, safety and economy. ★ Can be set on tubing or drill pipe—(or on a wire line by your choice of the leading electric wire line service organizations).

Save money, save time, get the

Don't waste time and money hauling kinked Kellys and bent drill pipe to the shop! ★ The Baker Portable Kelly and Pipe Straightener (Product No. 550) does a better job while the Kelly or pipe is suspended vertically through the table; and avoids possible damage in transporting and handling.

Use Baker BAKWIK Drill Pipe Floats (Product No. 480) to reduce wear and tear on wire lines and rig equipment. ★ Greatly reduces possibility of wet strings due to clogged bits and drill pipe.

You will have "BETTER RESULTS WITH BAKER"

For successful "first-time" cementing use a Baker Cement WASH-DOWN WHIRLER Float Shoe (Product No. 120) centered in the hole by a Baker Casing Centralizer. ★ If an additional "float" valve is desired, run a Baker Cement Float Collar (Product No. 101) up the string. ★ If one "floating unit" is sufficient for your casing string, use a Baker Float Collar a joint or two up the string and a Baker Cement WASH-DOWN WHIRLER *Guide* Shoe (Product No. 121) on bottom.

When your casing is equipped with Baker Model "G" Casing Centralizers (Product No. 910-G) you *know* that is REALLY CENTERED with better chances for a "first-time" water shut-off. ★ ★ In directional holes "sled-runner-action" of the springs helps to get pipe to bottom.

No more torn swab rubbers or packing elements. Slips on testers or packers can always contact casing. ★ A Baker ROTO-VERT Casing Scraper (Product No. 620-C) run on drill pipe, or a *wire line*, scrapes casing free from gun-shot burrs and hardened cement.

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lead to still other ways. This was supplemented by a field survey of current developments.

In the second phase, a dozen or so of the ideas turned up were selected for preliminary investigation and farmed out to various research organizations and consultants. Some idea of the feasibility of these ideas was obtained during a 4-month period of laboratory experiment and theoretical analysis.

In the third phase, two projects were selected for more thorough investigation. They are briefly labeled "Vibration Drilling" and "Arc Drilling." These were chosen because they satisfy two criteria: one, they show some degree of promise and, two, they utilize natural principles not essential to conventional drilling practices. Both ideas are now under investigation at a research institute. A 1-year program, running to February 28 of next year, is now more than half completed. It is not yet possible to say whether either idea can be reduced to economical practice. It can be said, however, that the arc method is a tough nut to crack. What it needs right now is a genius.

There will be a fourth phase, in which full-scale apparatus will be made and run in the hole, if present investigations of the vibration method or the arc method justify taking that step. Meanwhile, every effort is being made, through use of consultants and advisers, to learn of other principles and methods that might have been missed in the initial search.

EQUIPMENT MAINTENANCE

Rig Modernization

Important changes being made in equipment in order to meet competition; unitized rigs, portability stressed

THE competitive scramble toward more and more efficient operation has led contractors to scrutinize their equipment closely and to make a number of changes, many of these being rather thorough and some rather minor, but still important.

The trend toward unitization or packaging continues so that rig moves can be made as rapidly as possible. Toward this same end, contractors are paying more and more attention toward skidding rigs as a unit or in major assemblies in those areas where skidding is possible.

Also, contractors and companies with drilling tools are devoting a great deal of attention and time to modernizing their old rigs, converting them to modern types with thorough renovation and rebuilding programs. Several of the larger drilling companies, for example—Rocky Mountain and Noble—have remodeled a major portion of their equipment.

Rocky Mountain program.—Rocky Mountain has brought all of its 15 rigs into its shops and given them a thorough face lifting. As much uniformity as possible was built into the rigs. Water, air, and fuel piping has been built into the rig substructure and fitted with quick couplings for speed in fitting up. The substructure is divided into two bases fitted together with spreaders equipped with wedge-lock devices for quick connection and rapid erection. Each of the bases is equipped with steel bearing plates to eliminate wood matting, and these bases contain the chemical house, lube-oil storage, air receiver, and a brake-cooling water tank.

Rocky Mountain has replaced mud settling tanks with 60-ft. long metal troughs and two small shallow tanks, one on either end of the trough, for mud suction and mixing. The walkway is enclosed to serve as a storage space during moves, and the pipe racks break down into flat sections for ease in moving. The top of the walk provides a runway for a four-wheeled pipe dolly.

Extra pipe-racking platforms are provided on all rigs so that longer strings of pipe may be racked. An air winch, spooling a soft-laid wire line, takes the place of a catline. Air-powered impact wrenches are provided for liner changing and pump overhaul.

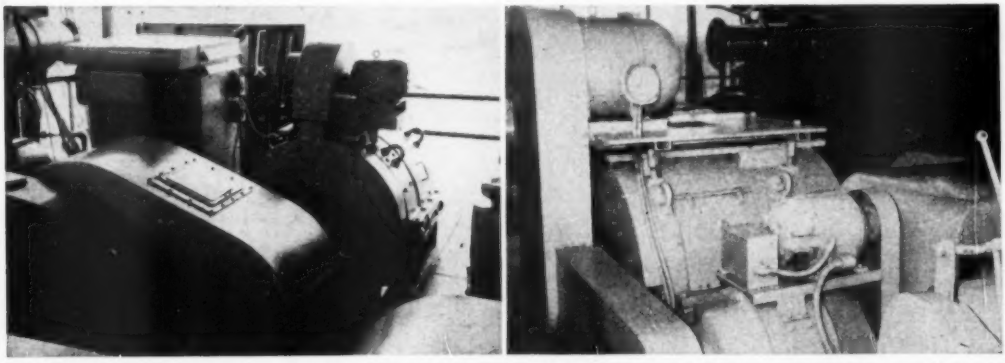
Noble modernization.—Noble Drilling Co. has renovated a large number of their old steam rigs, taking the steam draw works and driving it with a direct-current machine wired as a motor. Power for the motor is furnished by another direct-current machine driven by compounded internal-combustion engines. Twelve rigs have been modernized in this manner.

The compound transmission is fitted with an underdrive at the pump end, two sheaves being mounted in the substructure, driven by a vertical chain from the compound. These two sheaves drive the mud pumps at the same or different speeds.

The rotary table is also electrically driven by a separate motor so that the draw works need not be run for rotating the drill pipe. These rigs also use an air winch for catheading operations. Substructures for the rigs are specially fabricated by Noble and are telescoping for ease in adjusting the substructure height to the height of the rig floor.

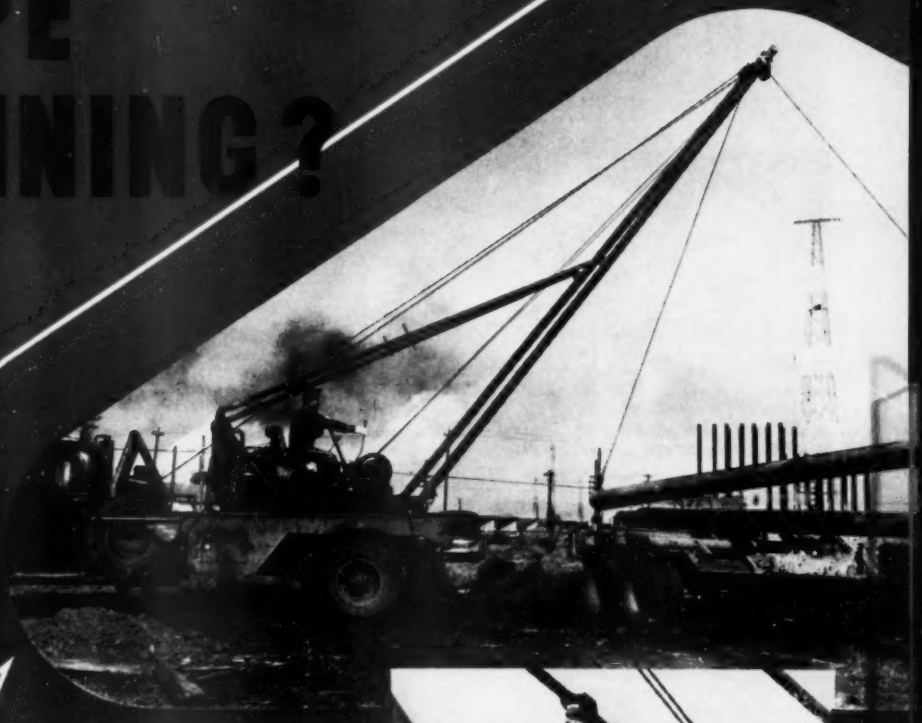
The direct-current machinery was purchased as war surplus.

Standard of California.—An unconventional rig has been devised by



MODERNIZED RIG.—Features of one of Noble Drilling Co.'s recently modernized rigs, are, left: Direct-current electric motor driving the draw works. In foreground is the 3-to-1 reduction chain drive to draw works. Right: Generator and excitation equipment with contactor box and switchgear at right.

PIPE GINNING?



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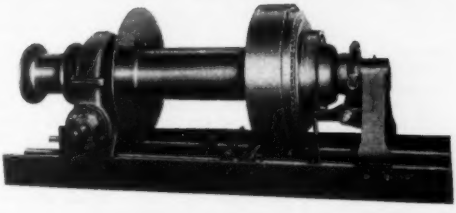

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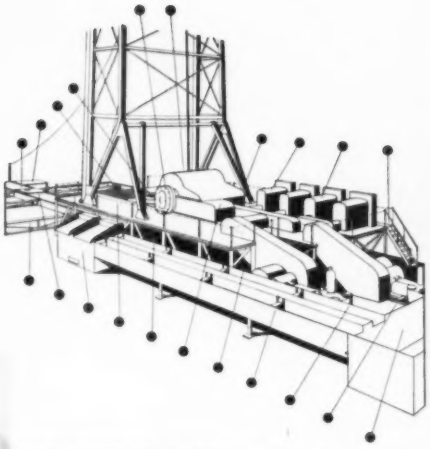
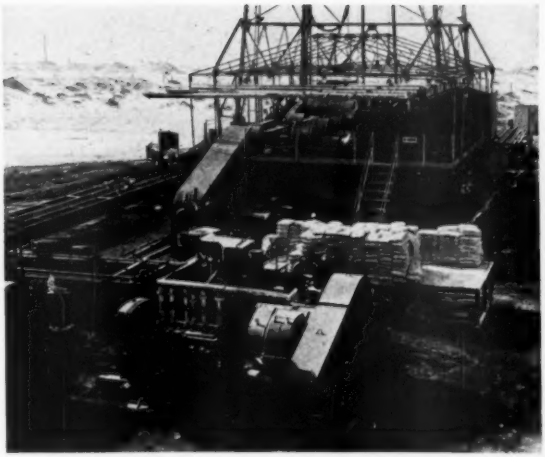




ROCKY MOUNTAIN DRILLING CO. RIG.—Dots on drawing at left refer to pieces of equipment that have been modernized in Rocky Mountain Drilling Co.'s rig pictured at right. This rig was used in opening a new 11,800-ft. producing zone in Montalvo, California, field.

engineers of Standard Oil Co. of California. This rig utilizes two locomotive-type diesel engines taken from a Navy LST, three electric submarine motors, and a steam-rig draw works.

The draw works is set beneath the rig floor with the drum opening facing away from the rotary table, and is powered by a direct-current motor. The two motors each deliver 1,200 hp. and turn direct-current generators that furnish current for the draw-works motors and mud pump and rotary-table motors. Two generators, one of 1,200 kw. rating and one of 300 kw., are mounted in line with the main engines. They may be paralleled or may be operated separately.

Electric and pneumatic controls provide the rigs with a large degree of sensitivity. Control current is supplied by generators driven by V-belts off the large generator shafts.

The rotary table and motor are mounted beneath the rig floor on a separately supported skid independently of the derrick. Mud pumps are driven by 500-hp. electric motors mounted with them on the same skid.

All motors are amplidyne controlled which permits very accurate control of power equipment. They also permit setting of a limit on torque delivered by the motors.

Tubular-Goods Care

Investment by the contractor in drill pipe and casing is high, and proper treatment is considered a "must"

ROTARY drilling contractors' investments in purchase and maintenance of tubular goods represents a very considerable portion of their expenditures, and proper treatment of these materials is a primary consideration.

Of course the drill stem, including drill pipe, drill collars, and the kelly, are most important to the driller, but treatment of other goods such as tubing and casing must also be given consideration although they probably do not belong to him. These latter materials should have recognition because their performance is often controlled by actions of the contractor on the well.

Surface Casing

The casing string that probably receives more damage during drilling operations than any other is the short-surface string. And in this string most of the damage is done at or near the top. This damage high in the casing string is due primarily to these causes: An improperly lined-up rig, a crooked hole, a crooked kelly, or failure to use protective rubbers on kelly sub and drill pipe.

Drilling the straight hole is either accomplished by drilling a small hole first and later reaming it to the desired size, or in areas where holes drill rather straight, and where rather small surface hole is drilled to begin with. Generally centralizers should be used on the surface pipe, and all joints should be welded for short distances around the joint. Excessive welding must be avoided because of the danger of breaking down the metal structure.

Both a float collar and a combination float and guide shoe should be used in cementing, and enough cement should be used to fill the annulus all the way to the surface. As much volume should be used as possible when pumping down the plug to avoid channeling of the cement. A good cementing job is essential in order to properly anchor blowout-prevention equipment. The cement plug should be drilled out with a rock bit rather than with a drag bit of any kind to avoid the possibility of hanging up in the casing.

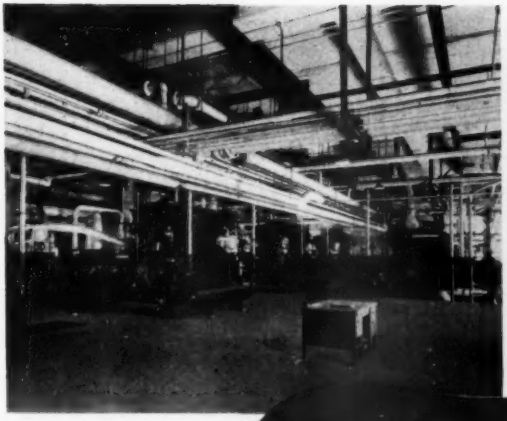
Drill Collars

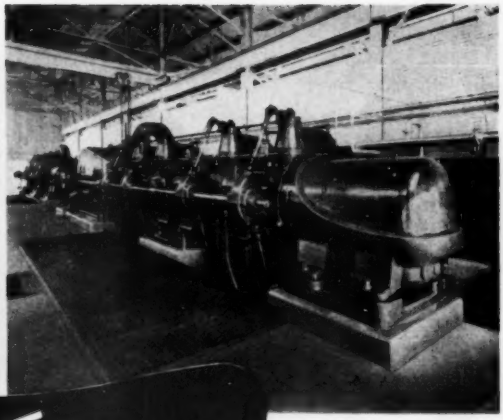
Drill collars now are also a critical item of tubular goods, the subject of high investment costs and difficult maintenance, particularly in areas such as West Texas where tremendously high bit loads and large numbers of collars are used.

Drill-collar failures are the direct result of one of two causes, according to Stanley Moore, of Drill Collar Service Co., Midland, Tex. The causes, he says, are simple fatigue in the case of the pins or corrosion fatigue in the boxes. Corrosion fatigue is limited to the boxes where heavily stressed thread roots are exposed to corrosion. And a great majority of these fatigue failures are the direct result of improper makeup torque.

Another factor affecting fatigue failures is improperly formed threads. Particular attention should be paid to having a rounded thread root since the rounded shape is less of a stress concentrator than is the sharp-cornered thread root found after field-shop machining. Still another critical factor is operation of the collars within a safe range. Just a little overloading of the joint will hasten failure.

(Continued on page 201)





The Pure Oil Company. A group of Cooper-Bessemer 4-cylinder, 400 hp GMV's, now going on 8 years of service in Pure Oil's Toledo refinery.

The Texas Company. One of six modern Cooper-Bessemer V-angles, 1000 hp GMV's in refinery service at this company's Eagles Point refinery, Westville, N. J. A duplicate plant has just been completed at Lawrenceville, Ill.

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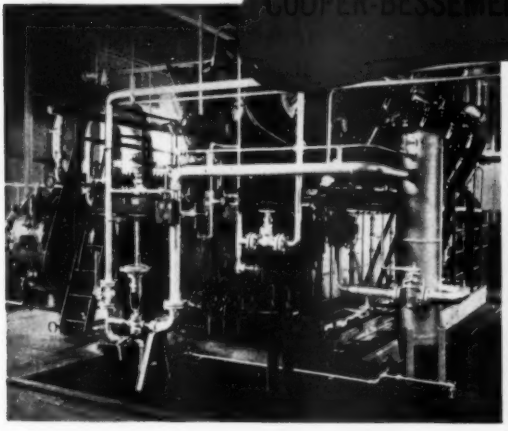
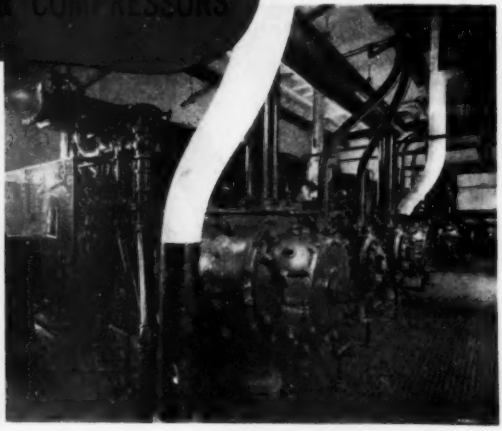
Humble Oil & Refining Company. Installed back in 1936, these two Cooper-Bessemer Type 26 horizontal gas engines drive hot oil pumps.

Continental Oil Company. View shows 600 hp GMV-6 and 800 hp GMV-8 handling air, recycle gas and propane in Continental's Ponca City, Oklahoma plant.





The above installation photos show only a few of the many Cooper-Bessemer compressor units that are serving faithfully, economically on jobs engineered by the M. W. Kellogg Company. Here at Cooper-Bessemer, we take pride in the fact that this successful association extends back many years, that we can continue to offer the M. W. Kellogg Company and their many fine customers engine and compressor performance that is unexcelled.

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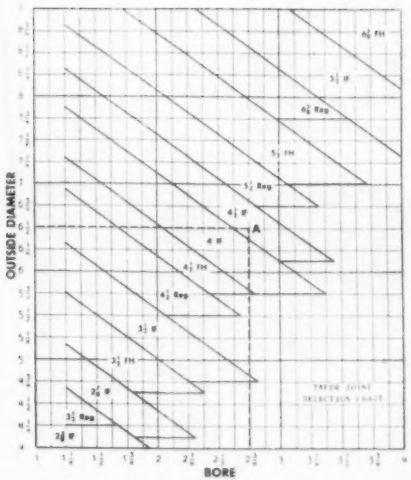
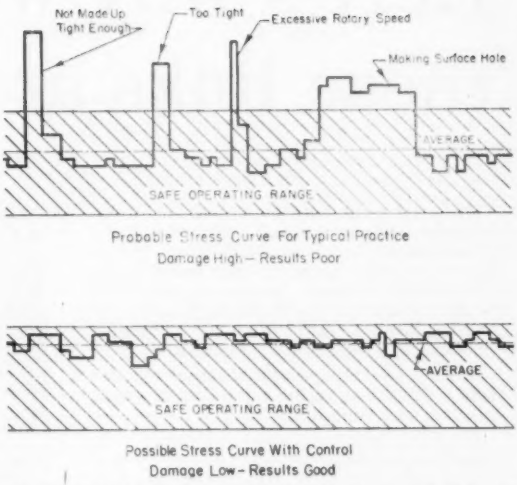




TO USE CHART (Example): Given a drill collar 6½-in. outside diameter by 2¾-in. bore, what is the best connection to use? Enter left side of chart at 6½ in. and go horizontally to intersection of vertical erected at 2¾-in. bore. This intersection "A" occurs in the area marked "4½-in. Internal Flush." Therefore, this particular connection would be the most symmetrical for the given case. (R. J. Stoup, A.P.I. report). Right: Graphical representation for comparing stresses produced by typical practice with those produced by controlled practices. (Stanley C. Moore, A.A.O.D.C. report.)

Other factors.—Still other factors to be considered are that small drill collars in a large hole will fail quicker than larger collars, and that crooked drill collars will cause early failure. Corrosion prevention also should provide an avenue toward longer life in drill collars.

Tong scars on the exterior of any kind of oil-well tubular goods will hasten failure, particularly in areas where corrosion is a problem. The notches occurring in these scars are extremely conducive to failure.

According to manufacturers of drill collars and drill pipe care must be taken to achieve balance in a joint, that is, to have nearly equal sections or wall thickness at the root of both the pin and box. Very often, particularly when shopping worn drill collars and sometimes when having thread cut on new collars, an improper joint is machined that will be out of balance and result in excessive stresses in either the box or the pin.

Drill collars.—Metallurgy of drill collars, although having some bearing on its characteristics, is not too important according to some manufacturers' representatives. They also feel that too much stress is laid on the manner of producing the collars, with too many drilling companies demanding forged collars when other methods of production would furnish a collar of almost equal desirability. According to these manufacturers a very important factor in drill collars is the strength of the collar at some distance below the surface of the collar, inside the collar wall, and ordering collars according to hardenability or H-band specifications especially with particular reference to the internal hardness of the collars is recommended.

Drill-Pipe Failures

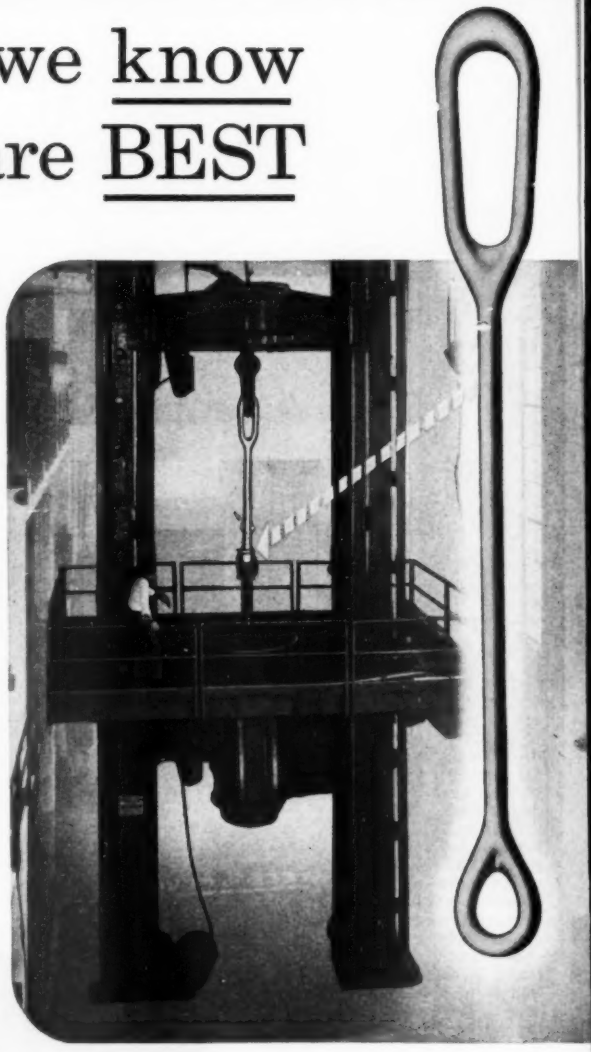
As with most other parts of the drill stem, failures in drill pipe are primarily due to fatigue as a result of bending at the last engaged joint thread, caused either by running pipe in crooked hole, running the pipe in compression, rotating unbalanced pipe at high speeds, and vibrations in the string from other causes.

According to full-scale tests conducted by Hughes Tool Co. and reported by William S. Bachman several factors influence these fatigue failures. Some of the surface conditions include pits and scale left in the pipe at manufacture, tong and slip marks, and peening of stenciling marks, all of which act as stress concentrators. Notches and pits of various kinds, including threads, affect various kinds of steel differently, high tensile-strength steels being affected to a greater degree. Corrosion also is said to have a large affect upon failures in drill pipe.

Fatigue failures.—A summary of Bachman's report on fatigue failures of tool-joint connections indicate that

***DRILL-PIPE INSPECTION USING MAGNAGLO POWDER TECHNIQUE.**—Pipe is magnetized (note electrical coil around pipe, at left) then powder distributed inside. In photo, the inspector is holding black light lamp. (S. A. Wenk and H. M. Banta, Battelle Memorial Institute.)*

Here's why we know these links are BEST



Only a test to destruction justifies the recommended load capacity and assignment of the 4 to 1 safety factor for Web Wilson FORGED Elevator Links. Links of each shank diameter, taken at random from stock, are *tested to destruction* on the Baldwin-Southwark Testing Machine (at right) which is capable of exerting a force of 4,000,000 pounds.

Here is scientific proof that these links are BEST, but let us consider the factors which result in such superiority . . .

Starting with engineering calculations which insure adequate steel at points of stress—made from steel better suited to the requirements, and higher in cost than is used in other makes of links—Web Wilson FORGED Elevator Links are the *only drop forged* links available today; welding is entirely eliminated.

Next follows heat treating to exacting standards in modern *vertical* furnaces to avoid warping or distortion—then each link is carefully "Magnafluxed" to assure uniform quality and freedom from *any* imperfections.

That's why we *know* that Web Wilson FORGED Elevator Links are BEST—that's why we can proudly say "They are the strongest 'link' in your drilling string."

WEB WILSON *forged* ELEVATOR LINKS

Shank Diameter INCHES	*Rated Capacity* TONS PER LINK	
1¾	65	*Lengths from*
2¼	110	*36 inches to*
2¾	150	*108 inches*

Tops in the field, WEB WILSON *Forged* ELEVATOR LINKS *today* provide *extra strength, extra safety and extra value* for heavy duty service and severe usage.

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Web Wilson FORGED Elevator Links are made from SAE 4140H steel which is considerably harder and more expensive to forge and heat treat than the steel used in other makes of links. You will find it worth while to refer to the chemical analysis of SAE 4140H steel, which is as follows: Carbon, .35 to .45; Manganese, .70 to 1.05; Chromium, .80 to 1.10; and Molybdenum, .15 to .25. Hardenability of SAE 4140H steel runs from 39 to 55. With a Brinell hardness of 350, the tensile strength is approximately 200,000 psi for SAE 4140H steel. Higher tensile strength; greater resistance to shock; higher toughness resulting in better resistance to wear—all vital factors in an elevator link—amply justify your approval and specification of Web Wilson Links over competitive makes.

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failures vary with the types of connections. In most threaded connections failure will generally occur in the last engaged thread rather than in the body of the pipe. The various kinds of welded-end and supporting land—either bucked or shrunk on—connection increase the life of the joints over the ordinary threaded tool-joint connection, both in the amount of stress and the number of cycles of application. From test data, however, the highest stress values before failure were obtained with the flash-welded tool joints which eliminate threaded attachment of the tool joint entirely. This type of welding also is said to be much more desirable than any kind of hand welding because of a much more uniform weld and considerably more strength at the weld line.

Inspection services.—Inspection services for finding fatigue cracks are becoming more and more widely used. Portable methods utilizing magnetic-flux leakage are finding more and more applications in field testing to spot these cracks during periodic inspections before breakage and fishing jobs occur while the pipe is in service.

Drill-Collar Stubbing

After long periods of use, either as a result of breakage or frequent shopping of joints, drill collars tend to become shortened. Excessive short drill collars are difficult to use in drilling operations, and oil-field machine shops have introduced methods of adding to the length of the short collars.

One of these methods consists of welding a short section of collar to the old one by means of thermit welding. In this process, a mold is formed of molding sand around a wooden mockup of the drill collars and weld. Passages are provided in the mold for pouring of the weld metal, for preheating the drill-collar stock, and for floating off any slag products formed in the welding combustion process.

The composition of the drill-collar pieces can be closely matched by the thermit welding material, and with proper heat treating a very good joint can be formed. Excess metal is machined off flush with the outside of the drill collar.

Electric arc welding.—Another method of joining two pieces of drill collar together is the use of electric arc welding. In this method the ends of the drill-collar pieces are chamfered so that when placed together a V-notch is formed. This notch is then filled with several successive passes of specially chosen welding rod, with extremely careful chipping and cleaning of successive passes of the welds. Careful selection of welding rod, together with heat treating of the joint will result in a very strong joint. Excess metal is used, and the excess is machined off after welding and heat treating.

Pump Maintenance

This vital part of rig should be in A-1 shape

A CRITICAL part of any drilling rig is the mud pump, and this item of machinery is particularly important and must be functioning when blowouts threaten and when mud must be mixed and pumped in a hurry.

Although liner changes should be kept to a minimum, they should be changed often enough so that excessive pressures do not overload the pump, prime mover, or drive. Manufacturer's ratings should be followed since as little as 10 per cent overload can reduce the life of the pump by as much as 25 per cent. Pressure relief valves should always match the liner size, and new piston rubbers should always be used with new liners.

The liners of the pump should fit closely on their outside diameter, and the liner spacer should be set up closely at all times to prevent loss of the liner packing.

Worn or damaged valve rubbers should be replaced immediately, and when replacing valves, the seat should be clean and dry and free of oil or grease.

Rods.—Piston rods that have become worn or scored should be removed since it is nearly impossible to pack them off. Rods must always be kept aligned in the center of the stuffing boxes, either by adjustment of crossheads or by replacement of pistons.

Clean oil of the proper grade for the temperatures encountered should be used in the crankcase, and any worn bearing should be replaced immediately to avoid ill effects from impact loading. All bolts should be kept as tight as possible.

Suction lines should be kept straight and of the same diameter of the suction of the pump. Long radius bends should be used wherever the piping turns.

When a pump is idle it should be protected by a coat of light grease.

MUDS, CIRCULATION, CEMENT

Mud Development

It has evolved into a new and complex science, and is considered significant in changing drilling practices

ONE of the most significant changes in drilling practices during the history of rotary drilling is the ever-increasing attention being paid to drilling mud. A new and complex science has evolved with the development of muds and mud engineering.

Some of the more important changes have been in the recognition and use of different kinds of basic types of muds—such as red lime, or lime-base muds, oil-emulsion muds, salt muds, and so on. Some of these specialized muds are restricted in use to certain areas; others are available for almost universal use. Some are only economical for drilling part of a deep hole; others can be used from the grass roots down.

In the Gulf Coast area of the United States limed or lime-base muds are widely used, particularly in the deeper drilling operations where much more accent must be placed on mud care and properties than in shallower work. The muds fundamentally consist of a natural clay-water mud to which various weighting materials and gels have been added, and which are treated by starches, caustics, organic thinners, and limes.

Advantages.—The limed muds have acquired their position in list of drilling techniques because of resistance to contamination and low cost of additives. Limed muds are almost immune to contamination by cement; they possess a high density without addition of weighting materials, and can absorb a large quantity of these materials without losing their desirable properties; they do not react to salt-water intrusion as do ordinary muds, and they can be successfully used to drill heaving-shale zones. Treating agents used in limed muds are normally cheaper than those necessary to make a water-base mud with similar usefulness.

A method of preparing limed muds, suggested by W. C. Goins, Jr., Gulf Oil Corp. is as follows:

Normal fresh-water muds are usually changed or "converted" to a limed-mud system after the intermediate casing string is set and in preparation for deep drilling. This is usually around 6,000 ft. but varies from well to well. Usual procedure is to first raise the pH of the mud system to 11.5 or better with a caustic-quebracho mixture and then to run to pilot test to determine what quantities of caustic, lime, and quebracho are required to give a low workable viscosity and gel strength. It is often necessary to add considerable water to the mud before the lime can be added and yet maintain a low workable viscosity. The quantities of starch necessary to give the desired low fluid loss is also determined by pilot

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test and all these materials are added to the mud system during one or more circulations.

Chemical requirements.—Quantities of chemicals required may vary considerably depending upon the type and quantity of mud solids and previous treatment, but usually are in the range of 1.0 to 2.5 lb. per barrel of caustic, 0.5 to 7.0 lb. per barrel of lime, and 0.5 to 2.0 lb. per barrel of quebracho or other thinner. Watering may be necessary to the extent of 25 per cent of the original mud volume and, depending on the fluid loss desired, 0 to 4.0 lb. per barrel of starch may be required. The end result is a relatively low-viscosity mud with low initial and 10-minute gel strengths and low fluid losses. Typical properties of a 12.5-lb. per gallon mud would be about as follows: pH, 13.0; viscosity (Marsh funnel), 50 seconds; thixotropy, initial, 0, 10-minutes, 3; fluid loss, 2.0 cc. filter cake thickness, 1/32-in.

Oil-Emulsion Muds

Improved performance of drilling muds through the addition of oil has been reported from all sides. Although oil has been used in various ways in drilling fluids and many other materials along with oil have been added to muds, it is only recently that effort has been concentrated toward the study of the so-called oil-emulsion mud systems.

The oil-emulsion muds, commonly referred to as just emulsion muds, consist of small droplets of oil surrounded by a continuous phase of water-base muds. Although the mechanism of making and maintaining the emulsion is not thoroughly understood, apparently they are formed through lowering interfacial tension between oil and water, formation and isolation of electrical charges, formation of insoluble films, and concentration of solid particles through adsorption.

One or more of the foregoing effects are necessary, it is generally agreed, in order to stabilize the emulsion. Stabilization is said to come about through a concentration of the emulsifying agent at the interface between the droplets of oil and the water.

Several types of compounds are suitable emulsifying agents, and one or more of these is nearly always present in ordinary water-base muds. Examples of these are shales, bentonites, and starches. Generally, however, emulsifying agents are added at the same time as the oil when preparing the emulsion. These agents are usually varied, depending on the types of formation to be drilled and the types of contamination encountered. Contaminants will effect the emulsion muds much as they would the same mud without the emulsified oil, and corrective treatment for such contamination is much the same as it would be without the oil. The added oil should not be considered as corrective measure for a bad mud, but rather as an additive that is designed to improve characteristics of a good mud.

Varieties of oil used.—Many varieties of oil have been used to form the emulsions, including several types of refined oils and crudes of widely varying properties. The type of oil will influence to some degree the ease of emulsification, the stability of the emulsion, mud and cuttings fluorescence, and the lubricating properties of the mud.

Results.—One of the results attributed to use of oil-emulsion muds in drilling have been an increased drilling rate or a decrease in drilling time. Other data collected by A.P.I. study committees have shown an increase in bit life, an improvement in bore-hole conditions particularly in heaving shales, and some increase in pump troubles particularly in rubber parts. These latter troubles may be almost eliminated by using various types of oil-resistant rubber. Costs of the mud reportedly are from $1 to $2 per barrel higher than ordinary muds.

Although there are objections, the emulsion muds do not seem to effect geological information from wells except in the case of side-wall cores. No profound effect upon electrical logs has been noted.

The above are only a few of the many kinds of muds available, all of which are almost tailor-made for specific kinds of drilling. Some of the remaining kinds of mud, described by J. P. Weichert, Gulf Oil Corp., are as follows:

MUD VISCOSITY.—The Marsh funnel test has been used by A.P.I. for many years as a standard procedure in measuring drilling mud viscosity.

Salt section muds.—Starch and other gelatinous organic colloids have been used to control the water loss of muds under conditions which normally flocculate colloidal clays. Very satisfactory salt-water muds can now be made using salt-water clays and drilling-mud starch. The starch may also be added to other muds when it is desired to lower the water loss.

When used, the starch must be protected against fermentation, this being accomplished by having the mud saturated with salt, carrying a pH above 12 or by the addition of preservatives such as formaldehyde, or sodium pentachlorophenate. It is most common to use starch in a high-pH mud, or if salt formation is to be drilled to use it in a saturated salt-water mud.

C.M.C. mud.—Carboxymethyl cellulose has recently come into use as a mud additive for controlling water loss. Its use is similar to that of starch; however, it does not need to be protected against fermentation which has made it a very valuable tool in certain types of mud. C.M.C. sells for considerably more than starch, but it usually takes much smaller quantities. It is sometimes cheaper to use C.M.C. than starch because of the expense of maintaining high pH values or other means of protecting against fermentation.

Oil and oil-base muds.—In certain formations it is possible to drill and complete very good wells with these muds, which if drilled with water-base fluids would produce little or no oil. Oil muds prevent the wetting of shale and other formations drilled and they prevent water blocking or sealing off oil-producing zones. Straight oil mud is essentially a mixture of a high-flash diesel oil, oxidized asphalt, and a soap formed in the mixture. The asphalt imparts sealing properties and the soap imparts viscosity and gel-strength control.

Silicate plugs.—Work with what is called a silicate plug has obtained interesting results. The plug consists of mixing a high-ratio silicate of soda and a thick fresh-water mud made from clays and treated with deflocculating agents so as to obtain a pumpable viscosity with a high solids content. The silicate and the slurry are mixed in place, and result in a rubbery gel which serves as the plugging agent. Proper use of slugs of the silicate and mud will mix the two at the point of loss, simultaneously squeezing them into the formation. A thick clay mud may also be thickened in a manner similar to that above by mixing with a high pH red mud.

Aside from the silicate-plug method which is suitable for rather extreme cases of lost returns, improvements have been made in the addition to mud of fibrous and flake materials,

which depends on the large solids being strained out and building a mat on which the drilling mud will build an impervious cake. It is usual that 100 to 150 bbl. of such mud be mixed and pumped into the hole in order to plug off the point of loss.

Silicate-brine mud.—Experience indicates that by using a mud of this type, cuttings from disintegrating shales will be carried to the surface whole, just as they were cut from the formation. By using this kind of mud, and by carrying adequate weight, heaving shales can be drilled without difficulty.

Still new.—The use of oil-base mud is still relatively new to the oil industry, although the theory connected with its use has been known for almost 20 years. Oil-base muds differ from each other as do water-base muds, and in order to obtain maximum results, certain desirable properties are essential. In general, a good oil-base drilling fluid is a synthetic mud which has most all the properties, and some qualities not possessed by water-base mud, plus the added advantages of not allowing the producing formation to become water blocked or mudded off. The use of oil-base mud is highly important to obtaining accurate core analysis and computation of reservoir information, reports George Miller, of Oil Base, Inc., Compton, Calif., in a paper delivered at the recent Third World Petroleum Congress held at The Hague, the Netherlands.

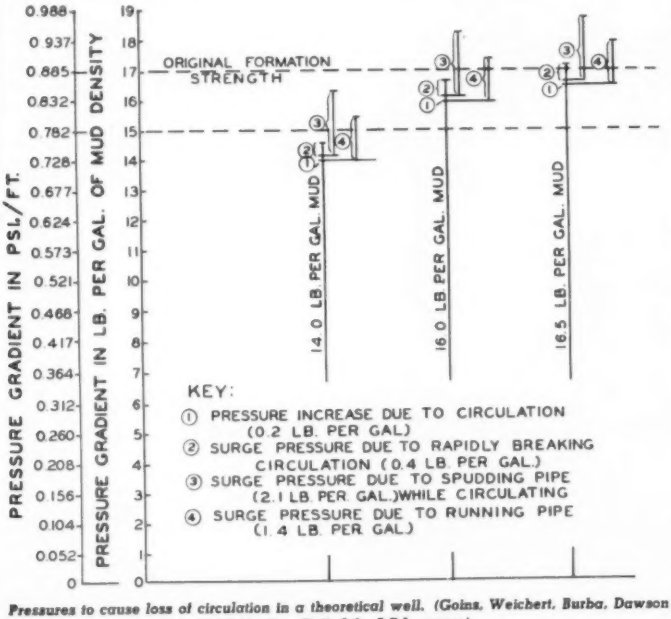
Results obtained during the past 10 years show the usage of desirable oil-base muds in some cases is the difference between a dry hole and a substantial producer. The majority of cases prove that use of a good oil-base drilling fluid in drilling the pay zone results in a higher initial well production and over a period of years the production comparison is even more amazing—sometimes amounting to a net difference to the well owner of several hundred thousand dollars per well, Miller states.

Lost-Circulation Fight

Hundreds of additives, techniques have been introduced to the drilling industry to save loss of muds, cement

ONE of the most dangerous and costly drilling hazards is the possibility of drilling into incompetent or cavernous formations that will take mud or cement at a rate high enough to cause loss of returns.

In order successfully to fight such loss of circulation hundreds of additives and techniques have been introduced. New materials are still being introduced and new intensive studies are being started.



Pressures to cause loss of circulation in a theoretical well. (Goins, Weichert, Burba, Dawson and Teplits, Gulf Oil; A.P.I. paper.)

Because of the seriousness of the lost-circulation problem in one area of the Gulf Coast, a group of Gulf Oil Corp. engineers were assigned to study wells being drilled in that area. This study indicated that the formations in which fluids were being lost were competent enough to withstand the hydrostatic head of a hole full of mud, but that high-pressure surges in the mud column caused the formations to break down and take fluid.

Surge causes.—These surges result from several different causes. Running the pipe at normal rates and rapidly spudding during pumping operations caused high pressure surges. These surges were aggravated in this case by balling on the drill collars and tool joints. Elimination of the balling by control of the mud properties, and slowing down any movements of the drill pipe eliminated loss of circulation in one well where in the three previous wells there had been 79 cases of circulation loss. Pumps were also opened slowly and circulation broken with as low a pump pressure as possible.

New materials.—Most of the new lost-circulation materials are of the granular types known as bridging materials. These are designed, through proper selection of grain shapes and sizes, to bridge over any porosity in a lost-circulation zone and through aggregation of smaller particles of the material and components of the mud effectively seal off any porous mud or cement-thieving zone. These materials are also used for such operations as setting and sealing packers.

These materials are also being added to cement slurries to fight lost returns. They derive their effect from being bridging agents and from their lightness. Since they are porous and of low density for the most part, they reduce the density of the cement slurry and therefore reduce the pressure the slurry exerts on the borehole walls.

High-gel cements.—Extremely high-gel content cements are being used to reduce lost-circulation troubles in cementing operations. Slurries with a gel content of as high as 12 per cent have been used without detrimental effects upon the cement. Because the gel is light and swells in water and requires and holds a lot of water for the slurry, the cement weight is effectively reduced, to 13 lb. per gal. in the 12 per cent mixture.

Cementing Practices

Techniques always under study to obtain better jobs

CEMENTING techniques are always under study for possible methods of improvement, particularly in the direction of obtaining better cement jobs and also in the matter of saving in time.

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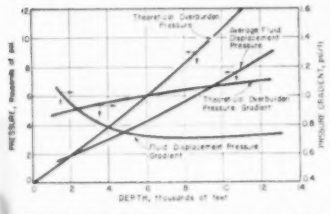
ed has been the use of two plugs in cementing, one above and one below the cement slurry. These plugs are designed to service a multiple purpose: To segregate the cement from the mud, to wipe the mud film off the pipe wall ahead of the cement and the top plug, and to assure a positive shut-off in the bottom of the pipe.

The bottom plug is designed to wipe the pipe closely, eliminating the thin film of mud in the pipe that would be wiped off ordinarily by the top plug, and cause cement contamination



SQUEEZE CEMENTING.—Comparison of theoretical overburden and fluid displacement pressures. (George C. Howard and C. R. Fast, Stanolind Oil & Gas Co.; A.P.I. paper.)

around the bottom of the pipe where a good cement job is essential. The bottom plug, traveling ahead of the cement, consists of a hollow tube covered with rubber, and closed in its upper end by a rubber diaphragm. When it seats on top of the float collar or cementing shoe the diaphragm ruptures and permits the cement to pass through. The two plugs are designed to fit together upon completion of the cement job to assure positive shut off of the mud column. Sharper cement tops, indicative of less cement contamination, have resulted from the use of a bottom plug in conjunction with the top one ordinarily used.

Squeezing study. — Cement-squeezing techniques have also undergone extensive investigation. Early in the process beliefs were that squeezing pressures were dependent on and equal to overburden pressure on the order of 1 psi. per foot of depth. This has apparently been proven wrong, however, since squeezing pressures are normally lower than this value, probably due to deformation of the rock in the well bore rather than lifting of the overburden, and structure in the rock overlying the squeezed zone that relieve the overburden pressure.

Shallow-well experiments with squeezing indicate that injected fluids generally form a thin horizontal "pancake" around the well bore and that successive squeeze jobs will force more cement in the same direction. Water has been indicated as a better agent than mud for breaking down the formation ahead of the cement since it provides a better-bonded set cement, except in highly permeable formations or those where water blocking may occur.

Quantity of cement placed in a given squeeze job can be controlled by slow or interrupted pumping of the slurry. Some success has been obtained in field tests with the use of a mixture of hydrochloric and hydrofluoric acids and sodium acid pyrophosphate as a break-down agent ahead of the cement.

DRILLING TECHNIQUES

Straight-Hole Drilling

Study of this problem by A.P.I. committees has led to several different drilling methods and techniques

INVESTIGATIONS of economics of drilling, fatigue failures in the drill stem, rates of penetration, etc., cannot be conducted without consideration of the problem of drilling a hole that will bottom within prescribed limits yet not have excessive changes of direction down the hole. The presence of relatively high-angle dog legs and spirals in the hole will lead to breakage of drill collars and pipe and will reduce the mechanical effectiveness of the drilling progress.

Studies of the so-called straight-hole problems by committees of the A.P.I. relative to rates of penetration have led to several different over-all drilling methods or techniques. These generally attempt to prevent drift of the bore hole usually at the expense of rate of penetration. One of these methods is use of oversize drill collars. This procedure involves risk, however, because fishing to recover any dropped collars is nearly impossible. Their use must be accompanied by all possible precautions against the possibility of fishing.

Collars of 7¾-in. and 8-in. diameters have been successfully used in 9-in. holes with bit weights of 14,000 lb. In a similar area, with smaller collars, a maximum of 8,000 lb. could be held on the bit without hole deviation. The oversize collars therefore permit larger bit weights with attendant increased penetration rate and time and cost to drill a well.

Caving problems.—In using oversize collars cavings from the sides of the hole present a problem, and large enough pump capacity must be provided to circulate these out of the hole to prevent sticking of the large collars.

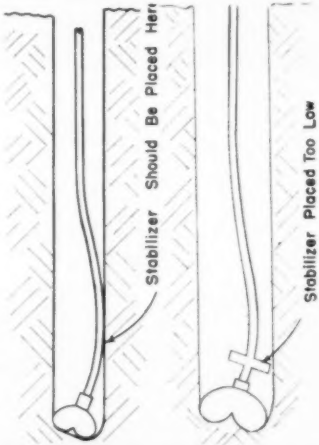
One of the unorthodox answers to the straight-hole problem is to ignore it completely. This procedure involves drilling to a point near the objective horizon, regardless of hole direction, survey the hole, and set a whipstock and deflect the hole into the prescribed target area of the pay horizon.

Second method used. — A second method of drilling straight holes is essentially a modification of the oversize collar technique. In this method, critical values of bit weight at which the drilling string will begin to buckle are determined, either by calculation or by experiment, and stabilizers are placed in the string at this point. With larger collars of course, the critical or buckling weight will be larger than with smaller collars, and it is possible to carry larger weights and increase drilling speed accordingly. If buckling in the drilling string is permitted, the hole will of course drift rather rapidly.

The influence of mud weight and inside diameter of the drill collars upon the point which the string buckles is negligible.

The calculated weights at which the string will buckle are almost identical with those determined in actual drilling operations, and is of course the only method applicable without causing deviation in the hole.

It is possible, when carrying weights over the critical value, to still drill a straight hole by placing stabilizers in the string at the points of buckling. These stabilizers should match the hole diameter closely and should be placed a distance above the bit within plus or minus 5 per cent of the correct value. If the stabilizer is placed too low or too high in the string it may be of no value at all.



***STABILIZERS.** — Location of stabilizers on drilling strings. (A.P.I. study by G. C. MacDonald, Gulf Oil, and Arthur Lubinsky, Stanolind.)*

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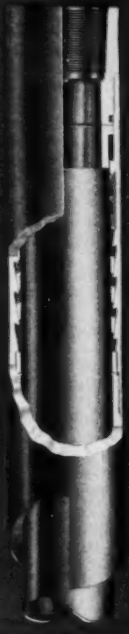

View showing Bowen-ITCO Casing Patch with protector ring in position.

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View showing casing in position in Bowen-ITCO Casing Patch after protector ring has been tripped by casing.

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Percussion drill.—Another development in straight-hole drilling is the percussion drill which drills with a combination of rotary and percussion motion. The percussion feature apparently permits the use of lighter bit weights while maintaining a given rate of penetration, a feature that should result in straighter holes. Coring and ratholing have been used as hole-straightening techniques but are not recommended as an initial straight-hole techniques.

A combination diamond core drill and rock bit has been introduced to drill straight holes. The diamond bit cuts a very short core and the rock bit, mounted inside the core bit, grinds up the core as it is formed. This tool is designed to give satisfactory rates of penetration while drilling with light bit weights.

TRANSPORTATION

Getting to Location

This sometimes is as expensive as drilling the well itself, but operators always solve problems involved

DRILLING an exploratory test can present its own peculiar problems—but sometimes getting to location can prove to offer more perplexing problems than the drilling itself.

In some instances, expenditures for preparing access roads, building bridges, transporting heavy equipment, and making other preparations for drilling have equaled or exceeded the cost of actually drilling the well to contracted depth.

But, since contractors do not give up easily, they always manage to get through, and nothing ever seems to stop them.

As an example of difficult problems arising in getting to the drillsite, Houston Oil Co. of Texas recently completed a wildcat test in one of the most inaccessible drilling locations in Gulf Coast oil history, (which resulted in a dry hole), with more money spent getting ready to drill than the actual drilling operations.

Difficult operation.—This operation, an 8,000-ft. test in southern Louisiana, was located in the Sabine River bottom of Calcasieu Parish. The well, 1 Joe J. Fisher et al, was situated only 1 mile off a state highway. However, it was necessary to construct six bridges totaling 710 ft. in length, or one-seventh of the entire route, in order to reach the site. Bridge-construction work was in addition to a difficult job of clearing and grading in swampy terrain.

Two weeks were spent on detailed preliminary surveys, consisting of an on-the-ground reconnaissance and close study of the records of the U. S. Geological Survey and U. S. Army Engineers.

Louisiana State Highway 7 passed within 1 mile of location. From the west, four wooden-trestle bridges with a rated load limit of 10 tons had to be crossed to reach the turnoff to the drilling site. From the east, five bridges with a similar load limit also had to be crossed.

Preliminary survey revealed that several major problems would be presented in drilling of the wildcat. Since the firm would have loads as high as 45 tons while moving in drilling equipment, the initial problem was that of crossing the state-highway bridges. Second major problem was presented by the weather.

With only a 60-day dry period it would be necessary to evolve a plan that could be executed quickly. A hurricane could cause high tides which would back up the river and inundate the location.

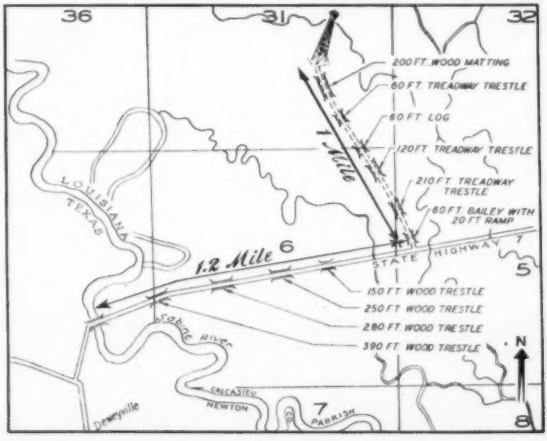
To cross the state-highway bridges, a bridge and equipment company reinforced them with steel treadways, which consisted of two parallel steel channel beams tied together laterally by I-beams, channels, and pipe sleeves. They were installed on top of existing bridges to take the bulk of the load, thus strengthening the structure.

Access road.—For the access road from the state highway to location, the bridge contractor supplied four bridges, which were in addition to a wood-matting bridge and a log bridge constructed by the road contractor. The road contractor cleared away the underbrush, and laid a board road the length of the route.

The state highway was under water twice immediately prior to the access-road construction, and once the road was completed, a hurricane delayed moving in drilling equipment for several days.

But once equipment was moved in, actual drilling time on the 8,000-ft test was 2 weeks. Total elapsed time for the entire venture—building the access roads, moving in drilling equipment, drilling the well, and tearing down, was 30 days.

As a precaution to heavy rains, which never materialized in this case, a 6-ft. earthen dike was thrown up around the drilling rig sufficiently to



HOUSTON OIL CO. OF TEXAS.—Left photo shows 210-ft. treadway trestle erected in less than 2 days. Map at right shows the many encumbrances between state highway and rig location: six bridges had to be built within a 1-mile stretch.

ANNOUNCING

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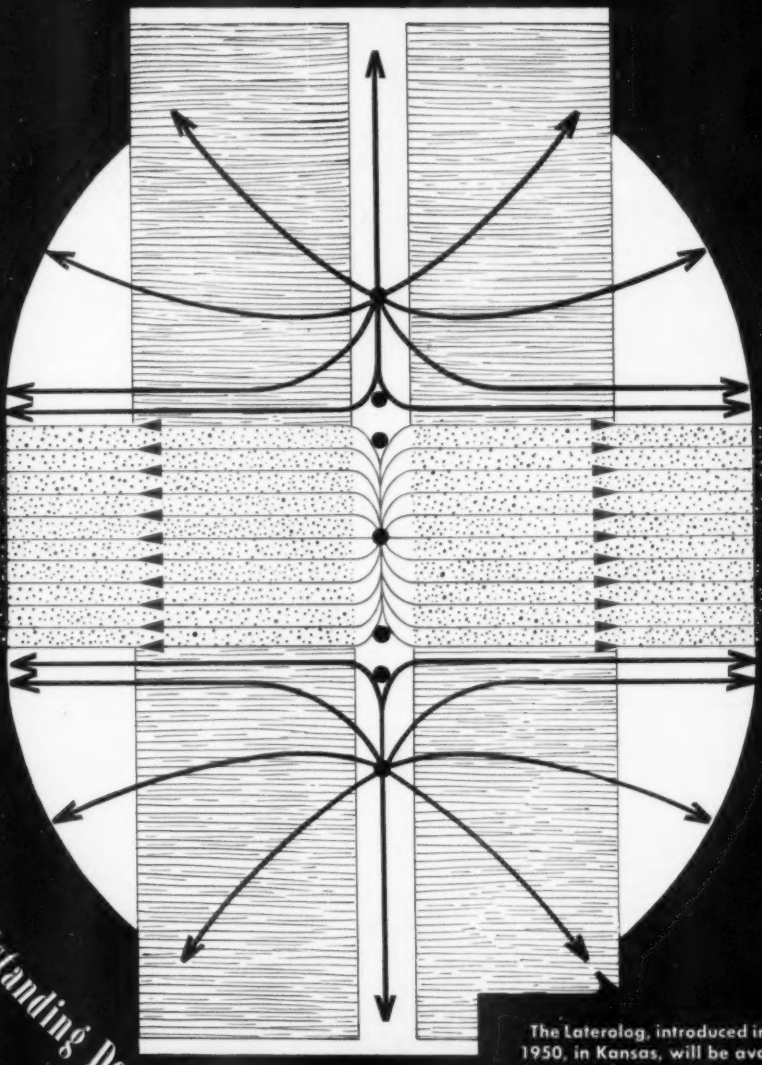
LATEROLOG



The Laterolog, introduced in October 1950, in Kansas, will be available in the United States on an industry-wide basis by January 1952. Write for further information.

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3 TIMES AS STRONG
as the pipe they connect!

In our simplified design for these tool joints, the reduction of area on the inside seal is so controlled that the seal becomes *tighter* as the tension load and pump pressure are increased. Repeated tension tests have shown this! And field reports are now substantiating the accuracy of these and other laboratory tests made on our *Straight Grip* Tool Joint for torsional fatigue; stress concentration; reverse torque and thread shear. Wherever used, these tool joints are being acclaimed for their positive protection against joint leakage and creep!

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Straight Grip
PAT. PENDING
TOOL JOINTS

4 POINTS OF SEAL

1. STABILIZER SEAL
2. THREAD SEAL
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4. SHOULDER SEAL

SIMPLIFIED FIELD INSTALLATION AND REMOVAL!
American Iron's new type portable furnace has a self-contained fuel unit. This and other newly developed equipment makes for faster, easier field installation and removal of tool joints.

EXCESS WHIP ELIMINATED!
Our controlled manufacturing techniques assure the perfect alignment of our tool joint connection with the drill pipe . . . eliminating excess whip in the drill string!

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Also mfgrs. of API, "Amweld" (counterbore weld) & Tubing Tool Joints

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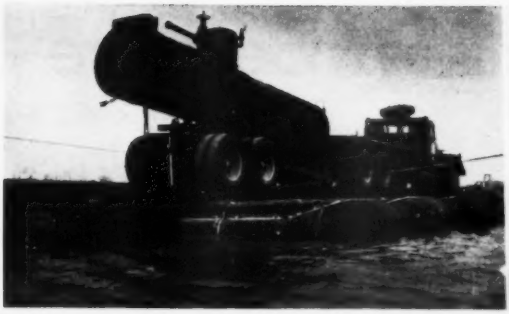
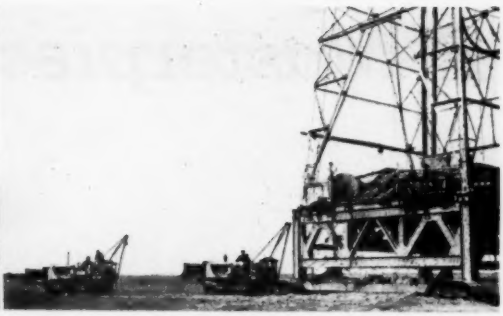




Left: Here a big oil-field transport truck and rig boiler cross a Nueces River estuary to a Humble location 12 miles northwest of Corpus Christi. Right: This job of skidding derrick and rig on a Shell Oil Co. location in Gohlke field, South Texas, a distance of 6,000 ft., took less than 1 hour.

protect the equipment from anything but a major flood.

Humble technique.—Humble Oil & Refining Co. utilizes a pontoon ferry to solve many of its problems in marshy locations. This setup is used in areas where lowlands would hardly support weight of a man.

The job is accomplished without building any expensive bridges and without any dock facilities. The small pontoon ferry is equipped with seven pontoons, each 33 ft. long and 8 ft. wide, joined together to form the base. Over these were laid parallel steel tracks to accommodate trucks. The steel tracks have flexible ends which slide upward on contact with timber ramps installed on both banks of the river, making a smooth connection between ferry and land.

Power to propel the ferry was supplied by a 10-hp. motor. To keep the small craft on course against wind, current, or tide, a rope reaches out on each side to pulleys which roll on heavy steel cables swung across the river 10 ft. above water level.

This unusual little vehicle made it possible at one site to carry across the river dump trucks hauling dirt and shell to build more than a mile of road and to raise the level at the building site itself up to 5 ft. above the marsh.

In addition the ferry had the big job of carrying heavy trucks which brought in boilers, draw works, derrick, and other drilling equipment. Taking them one at a time the ferry completed the whole job in 2 days without incident.

Shell skids rig.—Although softness of the Gulf Coast terrain makes skidding of rigs exceptionally difficult, Shell Oil Co. has recently adopted this method in its important Wilcox discovery, the Gohlke field.

Over 1,000,000 lb. of equipment was moved from one location to another in one working day when Shell's Rig 12 on 1 Musselmann at Gohlke field, South Texas, was skidded about 1½ miles to its new location. Moving the derrick intact by means of self-laying tracks, thereby eliminating the time and expense of dismantling and rigging up, saved 4 to 5 working days

Your Hand Will Tell You These Motors Are Good

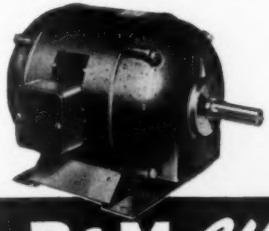
The next time you're out on a lease where R & M Motors are pumping, make this simple test. Feel how *cool* these motors are, and how smoothly and sweetly they run. You can tell at a touch that the parts you *can't see* are designed for utmost performance. R & M Motors are famous for cool operation—stamina—ability to take overload . . . everything you want, *and should have,* for dependable oil-country service. The thousands now in daily use invite your early comparison.

***Right,* FOR ALL YOUR NEEDS**

You can install All-Weather Motors anywhere —outdoors, without a cover; where it's dusty or damp. They're shielded from mice, snakes, and air-borne debris. Sizes to 50 h.p. All oil-field types. Write for Bulletin No. O-400-G.

Why
R&M MOTORS RUN COOLER

1. High-grade impregnated insulation (instead of asbestos) permits the use of larger wire diameters for less heating.
2. Special protective treatments prevent rust and corrosion, preserve radiation values, keep motor internally clean.
3. "Clean-Sweep" high-velocity end-to-end ventilation forces air both through the rotor and between the windings and shell.
4. Extra-wide ball bearings are fully sealed and pre-lubricated for years of cool, efficient operation.



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OR 10,000-FT.

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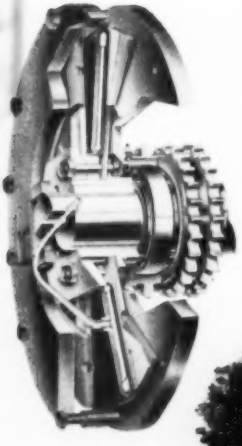

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CLUTCH

The Clutch That Has
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No Down Time,
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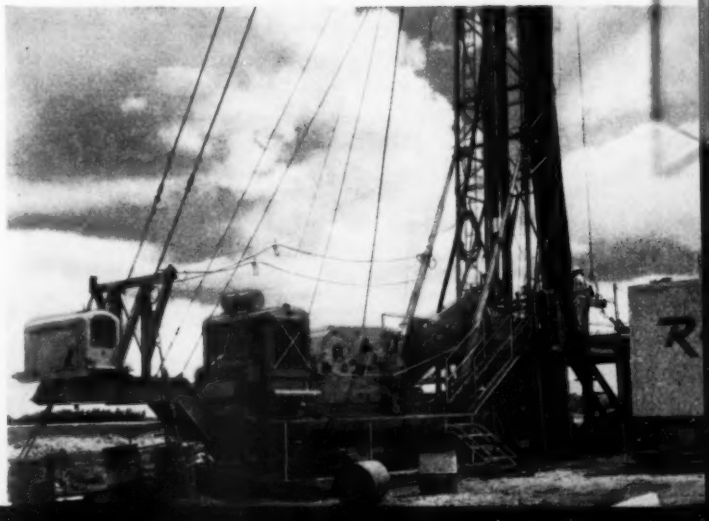
– A Triumph for Economy

A *Natural* FOR FAST MOVES

THIS Cardwell "Trailermast" and Model L draw works is the answer to your problem of expensive, time-wasting moves. The unified assembly of mast and draw works provides an extremely lightweight, portable rig that is moved complete with block fully reeved up.

The 96-foot height of the telescoping mast makes "mouse hole" connections possible. "Trailermast" has 150,000 pounds working capacity with a safety factor of 2. The frame is designed so any single engine draw works can be used with the "Trailermast." NO RAMP IS REQUIRED. The 16′ x 16′ derrick floor is high enough for blowout preventers and wellhead connections. "Trailermast" can be used without substructure on servicing jobs or ground level drilling. Write for complete specifications and prices; or see your nearest Cardwell representative.

The Model L draw works, single or double drum, is driven through a 4-speed and reverse transmission (or optional torque converter) to the "Hi-Lo" Cardwell "Flex-Disc" air friction clutched drive. Cardwell "Flex-Disc" air friction clutches mounted in the drums have ample capacity for full engine power without slippage.



Driller's position at base of mast gives full visibility. Mast is erected by hydraulic system and raised to full height with traveling block and drilling line.

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THIS TRADE MARK INSURES HIGHEST QUALITY AT LOWEST PRICE

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and 75 per cent monetary costs at this particular job.

Offshore work. — Drilling activity has been dormant in the tidelands area since the federal Government suspended operations, but when operations do resume, operators will again be faced with the same difficulties attendant in offshore operations.

Constructing drilling platforms, transporting equipment and supplies, limited working space available to the crew, and hazards due to weather conditions all lend to the complexities of drilling offshore—and add substantially to the costs of such operations.

River drilling. — Vagaries of the Mississippi River as it meanders between Louisiana and Mississippi adds to the headaches of drilling crews. Platforms in the river can become navigational hazards, and then there are problems of swirling currents and flood waters.

Humble recently had a lease fall at the bottom of the river adjoining its Avondale field, Louisiana, production. To get to it, crews had to drill to a target 200 ft. in diameter, 1,160 ft. north from the rig, and 8,200 ft. down. Directional drilling was begun at 3,600 ft., and a spud bit and two whipstocks were used to guide the hole in a gigantic spiral out under the river to 6,594 ft., where final whipstock was set. When bit reached true vertical depth of 8,200 ft., a survey showed the hole to be exactly 1,160 ft. from surface location, and only 50 ft. from the objective—easily within the target area. Well was drilled to 9,396 ft., total depth.

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Day in and day out, Quincy Compressors deliver the compressed air supply required. Modern . . . compact . . . rugged in construction, Quincy Compressors are available in wide variety of sizes ranging from 1 to 90 c.f.m. Depend on a Quincy specialist to help you select the type and size compressor to meet your needs. Write Dept. OG-2 for details and prices.

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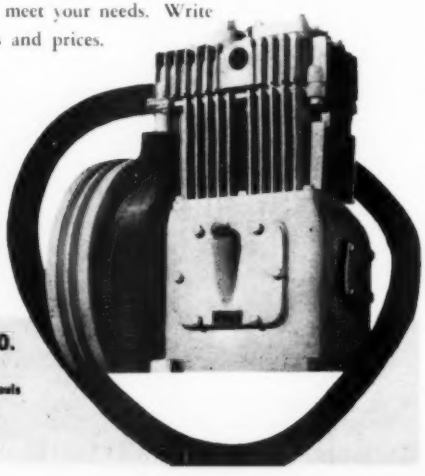

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FAST DRILLING

Record Broken

Humble's research pays off dramatically

A NEW world's record for fast drilling was set by a Humble Oil & Refining Co. drilling crew in South Louisiana recently, when 2,575 ft. of hole was made in a regular 8-hour tour, or an average depth of 322 ft. per hour.

The company's Rig 29 thus beat the record of 2,448 ft., which was set a few weeks earlier by Humble's Rig 28.

Application of knowledge gained from a 6-year drilling-research program has enabled the company to cut drilling time in many areas, and the new record was established in Lake Sand field of Louisiana. Using a jet-type drag bit, on which Humble has an extensive development program, the crew made the fast time in drilling a 9⅞-in. hole from 1,910 to 4,485 ft. The evening-tour crew which took over from there made additional hole with the same bit before it was necessary to change it. This single bit drilled 3,835 ft. in a total of only 13½ hours, down to 5,745 ft.

Jet bits responsible. — Use of jet-type bits is felt by Humble probably to be the most important single factor in the successful reduction in drilling time in a number of Gulf Coast areas. However, these bits represent only one phase of the firm's extensive program, which began in Louisiana back in 1944.

To initiate research, seven wells in a Louisiana field were drilled with slight changes in procedures. Report on these indicated a relationship between drilling speed and circulation rate, and consequently a research project was set up in 1946 to study factors affecting Gulf Coast drilling rates.

Where wells were being drilled through sections of uniform hardness in the same field, comparisons were made to isolate effects of different parts of the drilling process, including circulating rate of the drilling mud, weight on the bit, speed of rotation, and the nozzle velocity of mud passing through the bit.

Short sections drilled.—Short 30 to

AMERICAN IRON

VALVES and SEATS

Designed Right! Made Right!

Get MORE from your pumps with these long-lasting valves and seats! They have many exclusive, field-tested features, as shown by this illustration. Both valve and seat are made from high grade alloy steel forgings, precision-machined. They're fully heat treated in our new controlled atmosphere furnace—the most advanced method of heat treating known!

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with these American Iron Pump Specialties!

SOLD THRU SUPPLY STORES EVERYWHERE

160° Standpipe Gooseneck

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Long Sweep Tee

Slush Pump Compounding Valve

Slush Pump Release Valve

Long Sweep Ell with 2" Outlet

Long Sweep Full Flow Tee

Long Sweep Ell plain 90°

Long Sweep Ell plain 45°

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[illegible] its truest place in [illegible]-soaked bayous and [illegible] mountain ranges . . . from sweat-filled jungles and ice-coated regions . . . comes oil to head the critical products list of nations around the world.

Wherever oil is sought, found, produced and used, you'll find operators with their attention focused on Dresser products. The gargantuan task of bringing oil into use calls for a well-rounded team of highly efficient Dresser products like drilling muds (Magcobar), drilling bits (Security), Clark-Ideco mud pumps (Bovaird & Seyfang), compressors (Clark), drilling rigs and oilfield equipment (Ideco), pipeline couplings (Dresser Manufacturing Division), hydraulic oilwell pumps (Kobe), boiler feed, hot oil and deep-well plunger pumps (Pacific), centrifugal and positive blowers (Roots-Connersville), oxygen plants and storage tanks (Stacey Bros.). Write for complete details on any of this equipment.

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SECURITY Engineering Co., Inc.
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THE STACEY BROS. Gas
Construction Company
Cincinnati, Ohio

60-ft. sections were drilled where a uniform formation was encountered, while maintaining constant all but one of the factors affecting the drilling rate. That one factor was then varied from minimum to maximum to determine its effect on rate of penetration.

Effect of weight could not be considered known until it was tested when the other factors were in proper relationship for fastest drilling.

As tests progressed, several things began to appear significant. It was found that the drilling rate was proportional to the weight on the bit, the speed of rotation, the circulating rate, and the nozzle velocity of the fluid going through the bit. It had been thought, when tests were started, that the main purpose of the drilling mud was to flush the cuttings from the hole. Therefore a high-circulating rate would be best. It was found that higher circulating rates did speed drilling, but more and larger mud pumps were required for deep drilling. On the other hand a high nozzle velocity at the bit gave a larger boost to the drilling rate and no extra pumps or horsepower were required.

This was achieved early in the tests by using a bit with small watercourses which attempted to gain the optimum relationship between the circulating rate and nozzle velocity.

Since high nozzle velocities of 200 to 500 ft. per second wore bits out quickly, attention was given to bit design to make them last longer. Manufacturers cooperated and tungsten carbide nozzles were installed in the bits. Blades were straightened and faced with borium and tungsten carbide. The hard metals reduced abrasion and changes in blade and direction of the nozzles had an even greater effect on the bit's drilling characteristics.

Less equipment wear. — Reduced wear of equipment is another advantage of jet-type bits. There is less wear on drill pipe since there are fewer revolutions per foot drilled; less wear on all rig equipment, as everything operates at full capacity for a shorter time.

Success of research into facts affecting drag-bit drilling prompted Humble to turn to rock-bit drilling, and this work began in 1949. Results immediately showed increased drilling rates in medium-hard formations of from 10 to 100 per cent by application of principles which apply to drag-bit drilling.

Studies in rock-bit design and properties of drilling mud have shown promise of further results. Already known is the fact that the chemical properties of the mud are important with rock bits, and different types of muds have varying effects on drilling rate. The experimental rock bits, like the drag bits, have the mud stream or "jet" directed to flush the cuttings from the bottom rather than to clean the cutters.

TECHNICAL HINTS

Gas and Air Drilling

Natural gas aids in preventing lost circulation; the use of compressed air prevents formation contamination

THE latest techniques to be attempted are drilling with gas, either natural gas from wells, or compressed air.

The gas drilling is being done on a rather large scale in the San Juan basin area for completing drilling in gas wells. Air drilling has been tried in the Permian basin for completing a well in the Spraberry sandstone,

THE PIONEER OF
SELF-MOTIVATED SEPARATORS

- PROVEN PERFORMANCE
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- SAVES DRILLING COSTS

No drilling outfit should be without a Thompson Shale Separator and Sample Machine. The Thompson Separator does a twofold job: (1) it removes the shale and abrasives from valuable drilling mud, and (2) the amazingly accurate SAMPLE MACHINE collects cuttings all the time the separator is operating to give an accurate foot-by-foot analysis of the progress of the well. The value and accuracy of the Sample Machine is recognized by drilling and geologic authorities as the best method of obtaining samples.

Try THOMPSON, You'll See . . .
SOLD THROUGH SUPPLY STORES EVERYWHERE!

THOMPSON TOOL CO.
IOWA PARK, TEXAS

and has been used for drilling geophysical shot holes.

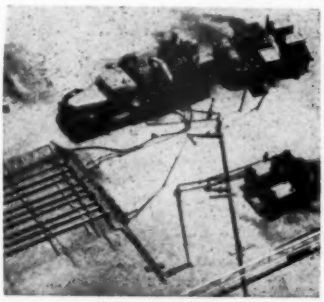
In San Juan drilling the terminal horizons are the Cliff House and Point Lookout sands which are separated by a cavernous coal seam into which circulation of ordinary muds was lost. To overcome this loss of circulation cable tools were used to drill in, and later the gas-drilling technique was involved in order to lower completion time.

Circulation.—Circulation of the gas is conventional, at about 400 psig. at the surface, and at rates varying from 1,500 to 2,000 M.c.f. per day. The drilling string is run through a 10-in. master valve and a double stripper head which deflects the gas flow into a 2-in. line that leads to a flare.

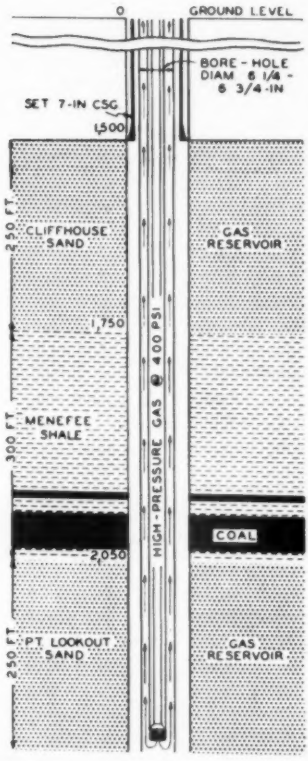
Operation with the natural gas has been very successful. Drilling in time has been reduced and no mechanical difficulty has been encountered. Bits apparently wear well.

The air-drilling technique was resorted to in an attempt to find a method of completing wells in the Spraberry sand without contamination of that formation with mud or other foreign matter.

Compressed air is furnished the rig at about 500 psi. after compression in two stages. Equipment at this first well included an assorted assem-



***AIR DRILLING.**—Experimental work by Carl B. King Drilling Co., Midland, Tex., on a Spraberry well of Penntex Oil Co., southeast Martin County, Texas. Shown are the second-stage compressor units, suction 125 psi., discharge 500 psi.*



***GAS DRILLING.**—Pay-section diagram showing gas as circulating medium as used in San Juan Basin, New Mexico. Gas passes downward through kelly, then through bit and upward through annulus to well head, and led away for flaring.*

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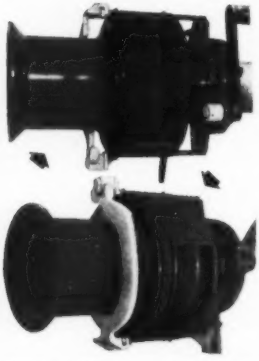
SAFETY ROPE GUARD

The FOSTER SAFETY ROPE GUARD is designed to attach to any FOSTER FRICTION CATHEAD



A guard of this type is required by law in some state safety codes. Members of the California State Safety Department say that during the years they have enforced the use of this type of guard, not one accident due to catline fouling has occurred.

An Anchor Spring Sleeve as shown in the lower picture is furnished with each FOSTER Safety Rope Guard to prevent drum crawl.

The guard is latched at the bottom and double hinged at the top so that it is easy to change the rope on the Cathead spool without threading the end of the rope through the guard.

Easy To Use • Easy To Install in the Field • Proved Practical

Foster Safety Rope Guard for Foster Spinning or Foster Breakout Catheads. In ordering specify type desired:

For 10" Cathead Spool..... $40.00
For 12" Cathead Spool..... $45.00

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P. D. Clemmer, Lafayette, Louisiana

Bill Lewis, driller for Helmerich & Payne, Tulsa, Oklahoma, says:

"REED REAMERS *do a good job for us"*

"We use these REED Extra Short Bit Reamers directly above the drilling bit . . . . . and these REED Short Bit Reamers with smooth rollers above the drill collar."

and here is the reason why:

"This method tends to eliminate the buckling action of the drill collar column, pilots the bit for straight hole, and keeps the hole in better condition."

Bill Lewis

REED ROLLER BIT COMPANY

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bly of portable air compressors, both single and two-stage machines, for the first main compression stage to about 125 psi. The final compression takes place in three single-stage machines. Air is circulated at a rate of 1,000,000 cu. ft. per day.

In this operation circulation is reversed over normal procedure, because it has been found that this method will produce cuttings of a size usable by geologists. Normal circulation produces powdered cuttings that are nearly useless.

Shot holes drilled.—In some of the dry areas of West Texas where water supply is a problem, and where surface formations are of such a nature as to cause lost circulation, geophysical shot holes are being drilled with air instead of mud. This procedure works very well in certain areas, but in areas where unconsolidated sands and large flows of subsurface water were encountered the method very often proved unsuccessful because of sticking drill pipe and other troubles.

Handy Drilling Chart

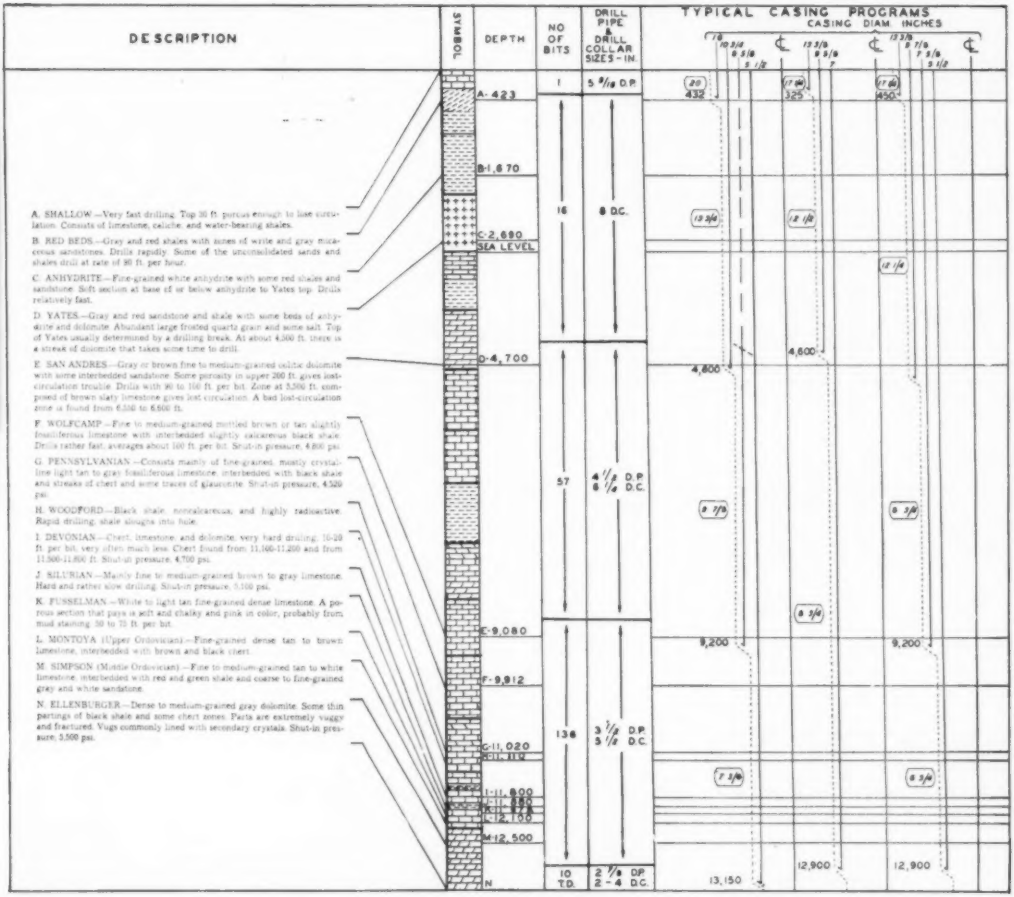
This type of Journal-prepared chart provides in quick fashion a summary of field drilling conditions

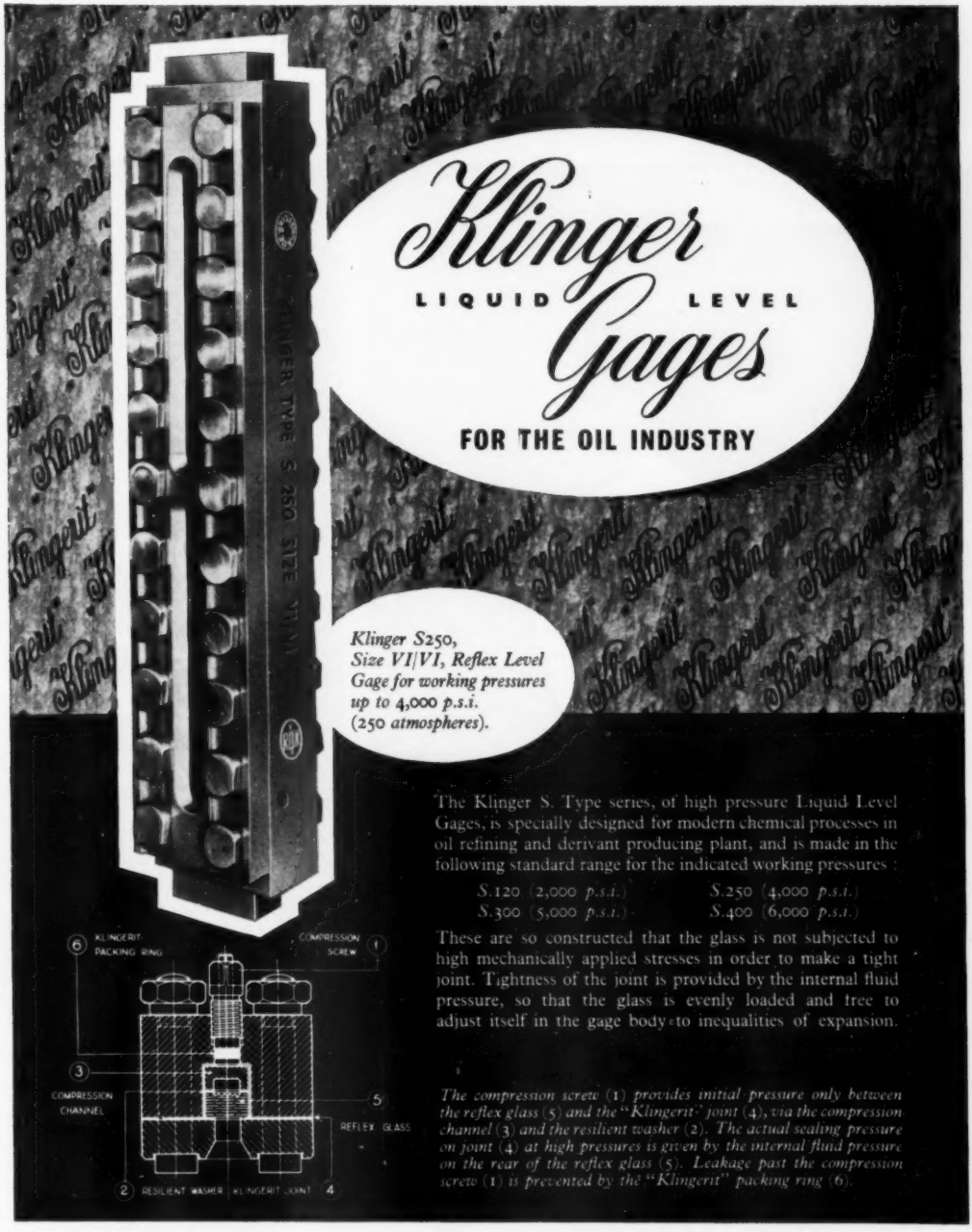
A CONCISE report of conditions encountered in drilling wells in the deep Pegasus field of West Texas is summarized on the accompanying chart. This sort of drawing provides in little space a summary of drilling conditions found in Pegasus field, current drilling practices there, hole sizes drilled, bits used, and casing programs that are possible.

A chart of this sort is invaluable in planning a drilling program, especially in an area new to the contractor. It should be of use to a contractor in preparing estimates of drilling costs and in preparing bids for drilling operations. The chart can be prepared upon the completion of the first well in an area or can often be approximated even before drilling has begun by a check of nearby operations and geological information.

Easily understood.—Information such as is presented on the chart is much more readily understood and will supplement or replace several thousand words of written reports on drilling procedure in any given area.

If desired, the information given could be broadened to include, on the same chart, mud programs and any changes therein with depth, hole volumes for both cementing and mud programs, and kinds of cement mixtures used for various strings of pipe.


DESCRIPTION
STRATA
DEPTH
NO OF BITS
DRILL PIPE & DRILL COLLAR SIZES - IN.
TYPICAL CASING PROGRAMS
CASING DIAM. INCHES
A. SHALLOW—Very fast drilling. Top 30 ft. porous enough to lose circulation. Consists of limestone, caliche, and water-bearing shales.
B. RED BEDS—Gray and red shales with zones of white and gray micaceous sandstones. Drills rapidly. Some of the unconsolidated sands and shales drill at rate of 80 ft. per hour.
C. ANHYDRITE—Fine-grained white anhydrite with some red shales and sandstone. Soft section at base of or below anhydrite to Yates top. Drills relatively fast.
D. YATES—Gray and red sandstone and shale with some beds of anhydrite and dolomite. Abundant large frosted quartz grain and some salt. Top of Yates usually determined by a drilling break. At about 4,300 ft. there is a streak of dolomite that takes some time to drill.
E. SAN ANDRES—Gray or brown fine to medium-grained oolitic dolomite with some interbedded sandstone. Some porosity in upper 200 ft. gives lost-circulation trouble. Drills with 90 to 100 ft. per hr. Zone at 3,500 ft. composed of brown slaty limestone gives lost circulation. A bad lost-circulation zone is found from 4,550 to 4,800 ft.
F. WOLFCAMP—Fine to medium-grained mottled brown or tan slightly fossiliferous limestone with interbedded slightly calcareous black shale. Drills rather fast, averages about 100 ft. per hr. Shut-in pressure, 4,800 psi.
G. PENNSYLVANIAN—Consists mainly of fine-grained, mostly crystalline light tan to gray fossiliferous limestone, interbedded with black shale and streaks of chert and some traces of glauconite. Shut-in pressure, 4,520 psi.
H. WOODFORD—Black shale, noncalcareous, and highly radioactive. Rapid drilling, shale sloughs into hole.
I. DEVONIAN—Chert, limestone, and dolomite, very hard drilling, 10-20 ft. per hr., very often much less. Chert found from 11,160-11,200 and from 11,300-11,800 ft. Shut-in pressure, 4,700 psi.
J. SILURIAN—Mainly fine to medium-grained brown to gray limestone. Hard and rather slow drilling. Shut-in pressure, 5,100 psi.
K. FUSSELMAN—White to light tan fine-grained dense limestone. A porous section that pays is soft and chalky and pink in color, probably from mud staining. 50 to 75 ft. per hr.
L. MONTOYA (Upper Ordovician)—Fine-grained dense tan to brown limestone, interbedded with brown and black chert.
M. SIMPSON (Middle Ordovician)—Fine to medium-grained tan to white limestone, interbedded with red and green shale and coarse to fine-grained gray and white sandstone.
N. ELLENBURGER—Dense to medium-grained gray dolomite. Some thin partings of black shale and some chert zones. Parts are extremely vuggy and fractured. Vugs commonly lined with secondary crystals. Shut-in pressure, 5,500 psi.
A- 423
B-1,870
C-2,690
SEA LEVEL
D-4,700
C-9,080
F-9,812
C-11,020
OIL LEVEL
I-11,600
J-11,880
K-11,975
L-12,100
M-12,500
N
1
16
57
136
10 T.D.
5 9/16 D.P.
8 D.C.
4 1/2 D.P.
6 1/4 D.C.
3 1/2 D.P.
5 1/2 D.C.
2 7/8 D.P.
2 - 4 D.C.
20
432
13 3/4
9 7/8
17 1/2
325
12 1/2
4,800
8 3/4
9,200
7 3/8
13,150
12,900
13 3/8
450
12 1/4
8 3/8
9,200
12,900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5 REFLEX GLASS
2 RESILIENT WASHER
KLINGERIT JOINT 4

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S.120 (2,000 *p.s.i.*)	S.250 (4,000 *p.s.i.*)
S.300 (5,000 *p.s.i.*)	S.400 (6,000 *p.s.i.*)

These are so constructed that the glass is not subjected to high mechanically applied stresses in order to make a tight joint. Tightness of the joint is provided by the internal fluid pressure, so that the glass is evenly loaded and free to adjust itself in the gage body to inequalities of expansion.

The compression screw (1) provides initial pressure only between the reflex glass (5) and the "Klingerit" joint (4), via the compression channel (3) and the resilient washer (2). The actual sealing pressure on joint (4) at high pressures is given by the internal fluid pressure on the rear of the reflex glass (5). Leakage past the compression screw (1) is prevented by the "Klingerit" packing ring (6).

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Drill-Hole Logging

Here is presented a generalized program, with possible variations, for testing of a well as it is being drilled

LOGGING methods and equipment are of immediate concern to a drilling contractor since a large percentage of the rig time on an exploratory drilling operation is spent in logging and testing of the bore hole as it is deepened.

Generally the most common procedure for testing a well is to conduct the tests as the well is drilled, in open hole. However, in some instances the well is drilled to total depth, usually to some predetermined horizon, then cased, and tested through casing perforations on the way out of the hole.

A generalized program with possible variations is given below for testing a well as it is drilled. This program, from an A.P.I. paper on testing of wells by John E. Walstrom, a West Coast logging consultant, also lists applications, advantages, and disadvantages of each method.

Shallower zones. — In cases where the terminal horizon for a well, for example the Ellenburger in West Texas, is by reputation very prolific but where shallower horizons also have possibilities of production, wells are often drilled to the deepest pay, cased to total depth, and then the shallower possibilities are tested in receding order of depth. These shallower zones are indicated by drilling breaks, electric logs run while drilling, or radioactivity logs run through the casing. A general plan, with variations, for this kind of testing program follows:

Procedure Program for Testing on Way in . . .

Variations of general program on basis of the number of techniques used for formation evaluation:

Plan A—

1. Install complete mud-logging or cuttings-analysis service
2. Obtain ditch samples for paleontological determinations.
3. Drill ahead and core if:
(a) significant oil shows;
(b) drilling breaks near objective interval.
4. Run electric log.
5. Side-wall sample as necessary.
6. Formation test as indicated.

Plan B—

1. Drill ahead and core if:
(a) significant oil shows on ditch;
(b) drilling breaks near objective interval.
2. Obtain ditch samples for paleontological determinations.
3. Run electric log.
4. Side-wall sample as necessary.
5. Formation test as indicated.

Plan C—

1. Drill ahead without coring.
2. Obtain ditch samples for paleontological determinations.
3. Run electric log.
4. Side-wall sample as necessary.
5. Formation test as indicated.

Variations of procedure on basis of drilling practices:

Plans A, B—

1. Coring may be done in reduced hole or full hole.
2. Side-wall samples may be obtained on logging cable or drill pipe and may be cored or punched depending on the type of formation. (This also applies to 1-C.)
3. Formation tests may be obtained using a shoulder or side-wall packer tool. (This may also apply to 1-C.)

Plan C—

1. Drilling may be in 500-1,000-ft. stages of reduced hole followed by running electric log, then reaming and testing any favorable intervals on basis of log or ditch shows. This method may necessitate plugging.
2. Drilling may be in full hole, reducing hole on a significant ditch show or drilling break.

General advantages for Plans A, B, C—

1. Bottom-hole tests in open hole on the way in are often more representative of true formation fluid because:
(a) Minimum contamination of formations by drilling fluid, filtrate, or cement.
(b) The possibility of a failure of the cement bonds behind the casing is avoided.
(c) The possibility of a plug leaking, or the tool slipping off a plug, when testing in open hole on the way out are avoided. (1-C, however, may require plugging.)
2. Bottom-hole tests of intervals of 100 to 300 ft. on the way in are often considerably less expensive than testing equivalent intervals inside casing on the way out and particularly so if water shut-offs are obtained above and below the interval to be tested.
3. More assurance of evaluating the shallower formations, since, if the well is not tested on the way in and is completed successfully in a deep objective, the shallower tests are very seldom made until the well becomes uneconomic, or must be made in another well.
4. Casing and cementing costs have not been incurred before the evidence of production is established.

General disadvantages for Plans A, B, C—

1. More time is required to reach the deepest lying objective than when testing on the way out.
2. More danger of losing the hole or fishing before reaching total depth than when testing on the way out. This may require sidetracking and redrilling before the lowermost objective can be evaluated.
3. Tests cannot always be made in the desired intervals. Better control of the interval to be tested is obtained my selective gun perforating.
4. Formation tests are usually limited to short duration due to danger of sticking tool. Testing inside casing allows swabbing or bailing and making a production test with considerable less danger.
5. In some areas, open hole testing may be dangerous below a certain depth due to sticking of the packer.
6. When drilling is rapid and the sands are thin, the bit may pass through the showings before the hole size is reduced. This would preclude the use of a shoulder type packer.

Applications for Plans A, B, C—

1. The general procedure of testing on the way in is best applied to wells drilled in highly unevaluated areas where several formations may prove to be of commercial value.
2. This general type of program is also adapted to wells of the semiexploratory nature drilled on the edge or near oil fields in which several commercial formations are known to be present.

. . . and on Way Out, Inside Casing

Variations of general program on basis of the number of techniques used for formation evaluation:

Plan A—

Same as Chart 1, Plan A.

Plan B—

Same as Chart 1, Plan B, except omit Item 5.

Plan C—

Same as Chart 1, Plan C, except omit Item 5.

Variations of procedure on basis of drilling practices for Plans A, B, C—

1. Coring and drilling are done in full hole since no formation tests are made on the way in.
2. Side-wall samples may be obtained on logging cable or drill pipe and may be cored or punched depending on type of formation.
3. Formation tests are made on the way out by selective gun perforating after cementing pipe. It is considered good practice to obtain water shutoffs above and below each interval to be tested.

General advantages for Plans A, B, C—

1. Can swab or bail and make a definitive production test of an interval which in some cases may be more representative of the formation fluid content.
2. The total depth of the well is reached more quickly and economically, than when testing on the way in. Thus, if the deepest objective is commercial, an economical well can be completed at a minimum cost.
3. If the hole is lost while testing on the way out the objective sands lying at maximum depth have already been evaluated. In this case it may be desirable to abandon the hole. On the other hand, if testing on the way in, it would be necessary to recover the fish, or redrill before evaluating the deepest objective.
4. Less probability of sticking packer inside casing than in open hole.
5. Can test a very long section of several hundred feet at one time if necessary.
6. Intervals to be tested can be selected as desired on basis of electric log.
7. There is less danger of losing the hole before total depth is reached than when testing on the way in.
8. Testing on the way out eliminates the necessity of drilling in reduced hole on the way in.

General disadvantages for Plans A, B, C—

1. Tests may be uncertain because the formations are exposed to mud, filtrate and cement for longer periods than when testing on the way in.
2. Casing and cementing costs incurred before production is evidenced.
3. Testing an interval of less than 200 ft. inside casing on the way out is usually more expensive than testing the equivalent interval in open hole on the way down.
4. Considerable difficulty may be encountered when testing or completing in an unconsolidated sand through gun perforations due to sand trouble.
5. Difficulty of establishing water shutoffs is sometimes considerable.
6. If deepest objective is commercial, shallower formations remain unevaluated since further testing may often be dispensed with.

Applications for Plans A, B, C—

1. Exploration at depths considered unsafe for the open hole type tester. See text.
2. Salvage in shallow sands after setting pipe for a deep objective which proves to be noncommercial.
3. Exploration in interbedded oil sands and wet sands.
4. Shallow exploration with multiple objectives where cost of pipe may not exceed cost of several tests.
5. Exploration in areas in which the electric log is diagnostic of the fluid content.

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Conditions and Practices

Current exploratory program centered in Devonian fields but other possibilities are by no means being overlooked

THE current oil-exploration and development program under way in western Canada tends to lean heavily toward the Devonian pays, but other possibilities, including the Cretaceous, Jurassic, Triassic, and Mississippian are not being overlooked.

Drilling depths in pool development in western Canada range from less than 2,000 ft. in the Cretaceous sand pools of Alberta and Saskatchewan, to over 12,000 ft. for Madison limestone production in the foothills. In Devonian pools the range is from 1,800 ft. at Norman Wells to 6,700 ft. at Normandville. Average depth at Redwater is 3,250 ft. and at Leduc 5,250 ft.

Conditions.—Drilling conditions in the area are not unusually difficult, although in the winter operations are reduced in scale. In the foothills the formations penetrated are extremely hard and steep dips and faults create straight-hole problems.

J. D. Gustafson, Imperial Oil, Ltd., Calgary, Alta., states that in the Central Alberta Plains the chief problem is that of lost circulation and blowout danger when drilling into fractured vuggy zones of the Devonian.

Gas is encountered in sands in the Belly River group, in the Viking zone, and in Lower Cretaceous sands as well as in the D-1 zone of the Devonian and at the top of the D-3.

The D-3 zone is extremely vuggy and apparently cavernous in some areas so that even when drilling-mud characteristics are carefully controlled, circulation is sometimes lost. This permits the gas zones higher up to blow out, the same conditions which precipitated the famous blowout of Atlantic No. 3 at Leduc.

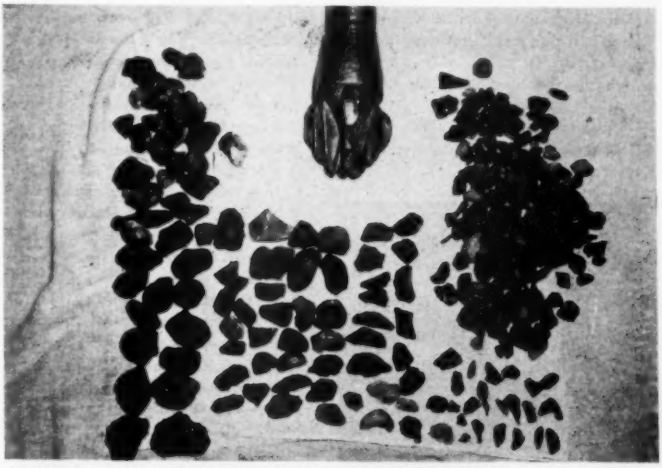
Casing program.—It has not been possible, Gustafson reports, to prevent occasional loss of circulation when drilling into the D-3 and similar horizons, but a casing program is now used which practically eliminates the blowout danger. For a D-3 well at Leduc, 10¾-in. surface pipe is set below the glacial drift, usually at a depth of 300 ft., and a 9-in. hole is then carried down to the base of the green shale just above the pay. At this depth a 7-in. long string is cemented in the hole and the D-3 zone is then drilled through the 7-in. The well is usually completed through perforations in a 5-in. liner, which is cemented from bottom hole through the D-3 gas cap and up into the 7-in.

Logging.—Gustafson reports that in addition to drill cutting and core examination, the most widely used form of logging in western Canada is the usual electric log. Gamma ray and neutron-log services are available and are finding good use for limestone-formation logging.

Probably the most valuable single tool for logging the vuggy fractured zones of the Devonian bioherms is the diamond core barrel. Core recovery in excess of 95 per cent is now usually achieved.

Technique and tools have been improved to the point where lost circulation does not prohibit coring. Diamond core head performance has been improved by increasing the hardness of the matrix and enlarging water courses.

Completion methods in Devonian



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Seismograph crews drilling shot holes along the Colorado River, south of Columbus, Texas, ran into what might have been a first class headache, as the photograph above will show.

They ran into soft clay and loose gravel formations 30 to 50 feet thick while drilling 90-foot holes. This means really tough drilling because drag bits can't break up the gravel, and rock bits ball up with the soft clay.

Hawthorne "Blue Demon" Rock Cutter Bits drilled through far faster, and the hole was far cleaner and straighter than normally obtained with other bits. Notice in the picture how much gravel was broken up by the Hawthorne Bits.

This is another example of how Hawthorne "Blue Demon" Rock Cutter Bits reduce bit costs and allow more production with fewer round trips for bit changes.

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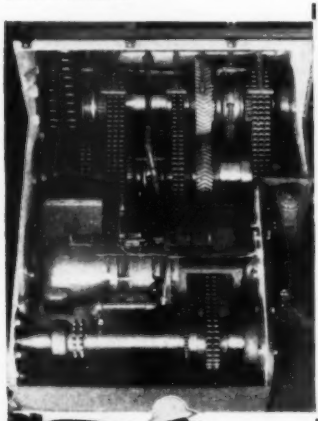
Take the unit which went out on the first T-25 Rig ever built by the National Supply Company, for example. For more than two years—drilling 74 wells, making a total of 220,000 feet of hole—the Twin Disc Torque Converter delivered power without that first sign of trouble, then it was given a field over-haul.

It is trouble-free performance like this, for less maintenance on the rest of the rig, less maintenance on the torque converter itself that makes operators prefer Twin Disc. Twin Disc Hydraulic Torque Converters, available in capacities up to 1,000 hp, cushion out shocks, dampen engine vibrations, and multiply engine torque instantaneously and automatically to match rig speed to rock formation hardness.



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pools vary with the type of reservoir, and to some extent because of the usual differences among operators' preferences.

In the relatively tight D-2 zone at Leduc, where lost circulation is not a problem, open-hole completions are made with casing set above the pay, after the hole has been drilled to total depth.

Acidizing is practiced as part of the completion usually only when necessary to cause the well to flow or to improve its flowing characteristics, Gustafson points out. Because the formation is predominantly dolomite, acidizing is not outstandingly successful in increasing initial potentials.

At Redwater where there is no gas cap to be shut off in the D-3 zone, most operators favor open-hole completions unless the well is drilled below the water table for reservoir information. Acidizing is widely practiced, not so much for the purpose of increasing potential as to decrease the differential between reservoir shut-in pressure and flowing pressure.

Operating conditions.—There is no lack of the usual oil-field specialized services including all types of well logging, acidizing, cementing, gun perforating, and laboratory facilities. Equipment supply-store stocks were somewhat limited up to 2 years ago but the supply situation with respect both to competition and stocks now

***CASTLE OF ICE.**—North Tangent No. 1 gas-distillate well of Hudson's Bay Oil & Gas Co., Ltd. This Albertan well took on weird shape during winter when temperatures ranged from 25° to 45° below zero. Spraying 150 bbl. of hot salt water per hour, the well built up a sheath of ice, broken only by the holes where the spray emitted.*

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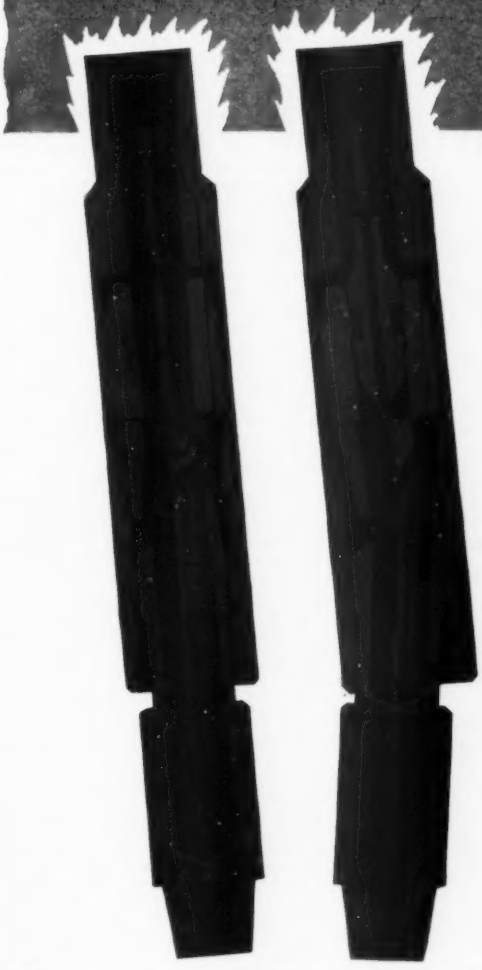

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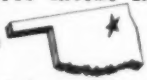
our native state 
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compares with most major oil-producing areas in the United States.

Drilling at Stettler.—Rigs used at Stettler are of medium depth rating (5,000 ft.) and use jack-knife derricks. Since a continuous supply of natural gas for fuel is not available, butane or diesel fuel is used. The drilling, casing, and mud programs are designed for the particular section penetrated and completion.

Mud practices.—In general there are no drilling or mud problems above the top of the D-1 zone. Approximately 600 ft. of 10¾-in. o.d. H-40 casing is cemented in a 13-in. hole with 350 sacks of cement which is sufficient to circulate to the surface behind the pipe. A 9-in. hole is drilled below the shoe of the surface pipe to the top of the D-1 using a mud program which consists primarily of clear water dilution of the natural muds made by the formation.

No appreciable circulation losses are encountered in the D-2 zone but some loss of fluid always accompanies penetration into the D-3 zone. Prior to entering the D-3, 7-in. o.d. J-55 casing is cemented with approximately 400 sacks of cement. About 300 ft. of scratchers and centralizers are installed on the 7-in. casing from the shoe up; cement fillups of from 1,400 to 1,600 ft. are achieved.

Bits; coring.—Penetration below the shoe of the 7-in. into the D-3 zone is taken with either a 6⅛-in. rock bit or diamond core barrel. The present policy is to core one well on each 160 acres.

Drilling time from spud to the top of the D-3 is usually 27 to 28 days. Running casing, waiting on cement, drilling or coring the D-3, placing the well on production, and tearing down rotary tools requires approximately 10 additional days. Extensive coring or drill-stem testing programs in either the D-2 or D-3 zone increase the over-all time.

There are no particularly hard or abrasive sections to be penetrated in the Stettler area and straight-hole drilling does not present much of a drilling problem. One surface-hole bit and nineteen 9-in. rock bits are generally required to reach the top of the D-3 zone. One 6⅛-in. rock bit or core head is usually adequate for penetration below the 7-in. casing shoe.

Well-Completion Details

In Stettler pool proper the oil-water contact is fairly well established in both the D-2 and D-3 zones. It is customary to bottom the hole from 16 to 18 ft. above the known water level in the D-3 zone. In the two wells which failed to find D-3 above the water level, casing was run below the base of the D-2. This permitted exposure of the D-2 through casing perforations without the necessity of drilling the plug from the casing. Such completion practice provides an adequate plug to protect the D-2 from fluids in the section below.

What's NEW

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Pipe is scarce and rig time is costly. What could be more economical than backing-off the pipe, recovering all free pipe above the stuck point in one piece, and getting it done in a fraction of the time?

Yet there are limitations in the use of only ONE back-off tool in attempting to free stuck drill pipe, drill collars, subs, casing, tubing and wash pipe. NO ONE TOOL can accomplish EVERY back-off job. But there are TWO back-off tools and between the two, EVERY TYPE OF back-off job can be accomplished!

That is why McCullough crews arrive at your well with both the McCullough Jet Back-Off Tool and String Shot. These tools plus the McCullough Magna-Tector, that quickly and accurately locates the stuck point, represent an extremely versatile combination service designed to save you time, money and pipe.

These are NOT mechanical tools or fishing tools. They are progressive tools, electronically controlled for accuracy and speed. They are responsible for the sharp decline in fishing in recent years, permitting wells to be drilled faster—saving oil operators thousands of dollars!

HOW YOU SAVE TIME, MONEY AND PIPE

1. TIME SAVER

a. Accuracy of the McCullough Magna-Tector in locating the stuck point consistently, eliminates unnecessary back-off shots.

b. New, high-temperature, high-pressure resistant detonators in the back-off tools eliminate misruns.

c. These electric wire line tools are run into and out of the well in a fraction of the time required with mechanical cutters.

d. In addition they are electronically controlled permitting greater speed and accuracy than ordinary electric wire line tools.

e. Electronics also provide MORE information about conditions in the well—locating collars, tight places, fluid level, etc., both audibly and visibly.

2. MONEY SAVER

a. McCullough Back-Off Service accomplishes ANY TYPE of back-off job, leaving the fish in good condition for subsequent operations.

b. The use and need of a rotary table is eliminated.

c. McCullough Magna-Tector, many times indicates that working and spotting oil will free the pipe, eliminating the need of backing-off and fishing.

d. Guesswork is eliminated.

3 PIPE SAVER

a. Eliminates cutting and damage to the pipe.

b. Permits recovery of all free pipe in one piece and the freeing and recovery of all stuck pipe in undamaged sections.

WHAT TO DO

When your pipe becomes stuck—CALL McCULLOUGH IMMEDIATELY! The McCullough Magna-Tector will quickly locate the lowest free point, the stuck point and do it accurately. Then the McCullough Back-Off Service will free all loose pipe in one piece—simplifying the fishing job.

Since time is important McCullough Back-Off Service is fast. All free pipe will be removed BEFORE it can stick further up the hole.

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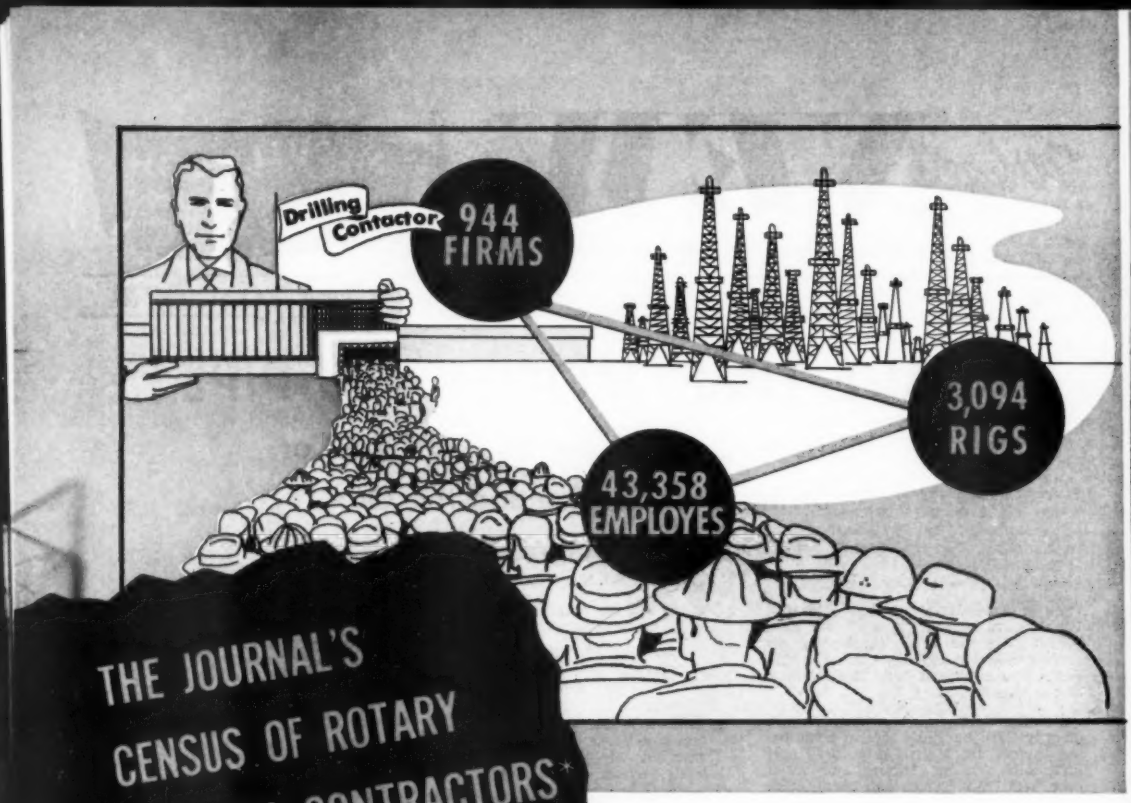


THE JOURNAL'S CENSUS OF ROTARY DRILLING CONTRACTORS*

THE rotary-drilling-contracting industry is continuing the rapid growth it has enjoyed during the past 5 years, both in the number of rigs owned and operated, and in the number of employes on company payrolls.

The Oil and Gas Journal's second exclusive census of this aggressive business reveals that there are a total of 3,094 rotary rigs owned in the United States by 944 rotary drilling contractors. In round numbers, the rotary-contracting business' operations now amount to more than 1¼ million dollars per day gross.

At the time the census was taken, there were 2,119 rotaries in actual operation, with the remainder termed "capable of immediate operation."

No cable-tool contractors were included in the census, and the figures do not include employes of drilling departments of oil companies, nor were work-over or service rigs incorporated.

How Many Employes?

The Journal's census of the rotary-drilling industry reveals that there are 43,358 employes on the payroll of the 944 contracting companies who operate the 3,094 rigs. The census also shows that 170 of the 944 rotary contractors also own a total of 377 cable-tool rigs.

*Results of the Journal's first census of rotary-drilling contractors were published in last year's annual "Drilling Contractors and Equipment Issue, October 5, 1950, pp. 134-135.

A breakdown of the categories under which these 43,358 employes are classified shows that there are distributed as follows: Owners, partners, and executives, including those who push their own tools, 1,851; tool pushers and field superintendents, 2,071; drillers and rig helpers (when 2,119 rigs were running), 31,740; others, 7,696.

Analysis of 944 Contractors

The Journal's analysis of the 944 rotary-drilling contractors shows that, by percentages, 12 contractors own 13 per cent of all rigs; 32 contractors own 22 per cent; 190 contractors own 54 per cent; 639 contractors own 90 per cent; 12 contractors own 20 or more rigs; 31 contractors own 10 to 20 rigs; 591 contractors own 2 to 10 rigs; and 310 own 1 rig each.

Personnel

There were 1,816 superintendents and tool pushers supervising the 2,119 rigs running when the census was made. This is where 90.6 per cent of them headquarter:

West Texas-New Mexico, 692 tool pushers, or 38.1 per cent.

Texas Gulf Coast, 317 tool pushers, or 17.5 per cent.

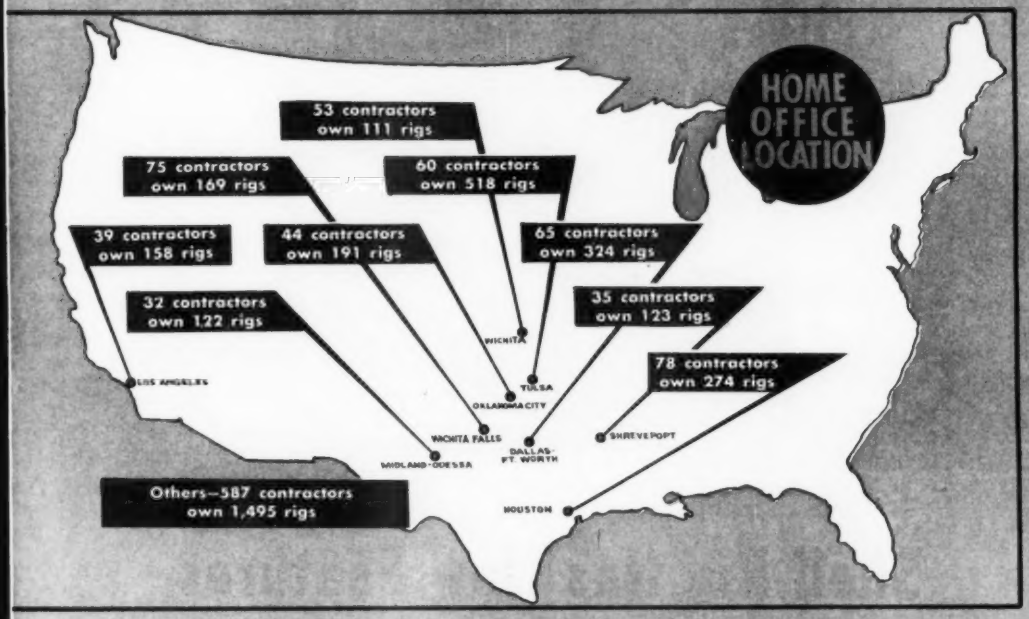
Oklahoma, 238 tool pushers, or 13.1 per cent.

California, 123 tool pushers, or 6.8 per cent.

Louisiana Gulf Coast, 171 tool pushers, or 9.4 per cent.

Rocky Mountains, 104 tool pushers, or 5.7 per cent.

There are many combination drillers-tool pushers, for, if a rig is shut down and stacked, the pusher for that rig goes back to driller until vacancy occurs in his company, or until stacked rig is placed in operation.



Where Are Home Offices of 944 Contractors Who Own These 3,094 Rigs?

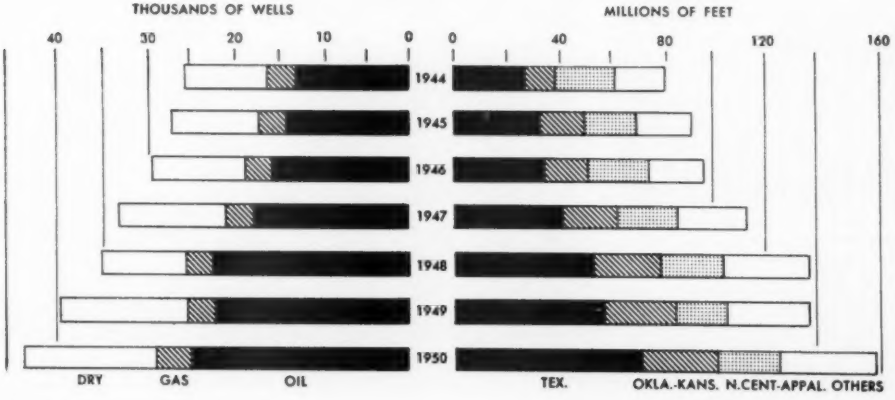
The Journal's census shows:

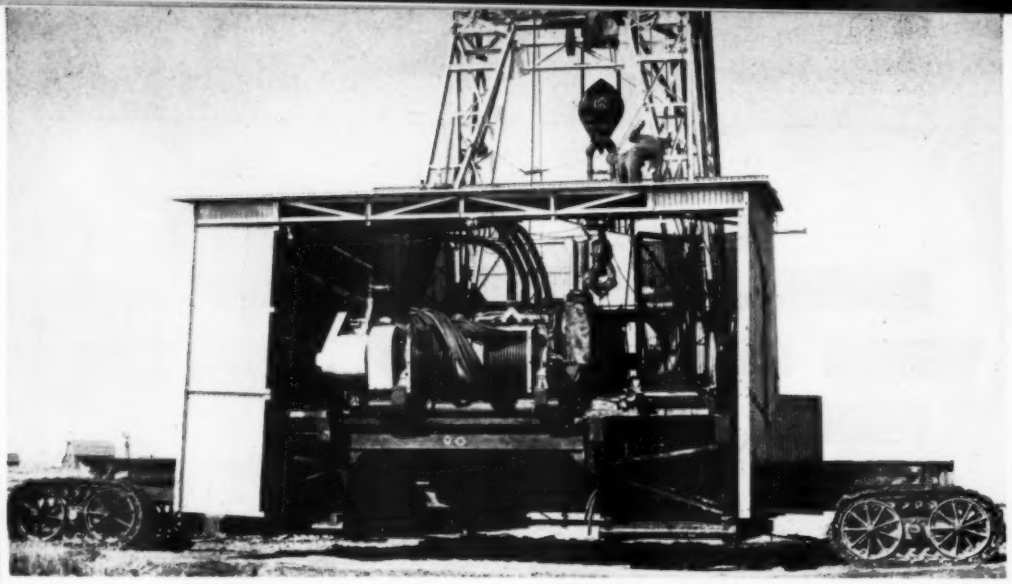
Texas, 410 contractors owning 1,380 rigs.
Oklahoma, 155 contractors owning 818 rigs.
California, 58 contractors owning 198 rigs.
Louisiana, 56 contractors owning 171 rigs.
Kansas, 89 contractors owning 168 rigs.
Illinois, 61 contractors owning 111 rigs.
Others, 115 contractors owning 248 rigs.

Where Is Concentration of Home-Office Control for Rigs Owned by Cities?

Tulsa, 60 contractors owning 518 rigs.
Houston, 78 contractors owning 274 rigs.
Fort Worth-Dallas, 65 contractors owning 324 rigs.
Oklahoma City, 44 contractors owning 191 rigs.
Shreveport, 35 contractors owning 123 rigs.
Wichita Falls, 75 contractors owning 169 rigs.
Others, 587 contractors owning 1,495 rigs (includes Los Angeles - Long Beach, Midland - Odessa, and Wichita).

TOTAL U. S. COMPLETIONS—1950





Arrangement of Shell Oil Co. rig using two I-beams and four Athey wagons.

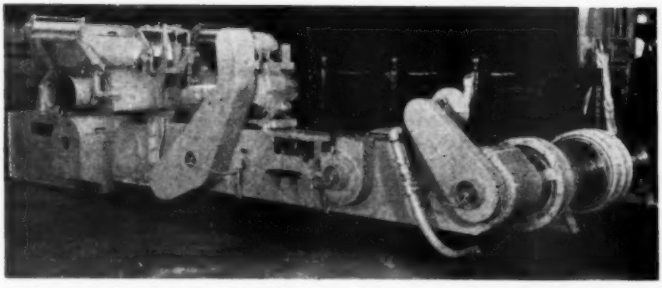
Shell Rig Has New Features

Stepdown substructure has unusual arrangement; rig can be skidded with I-beams and Athey wagons; three-component sections make for easy hauling; special compound-mounting brackets reduce road clearance for highway moves.

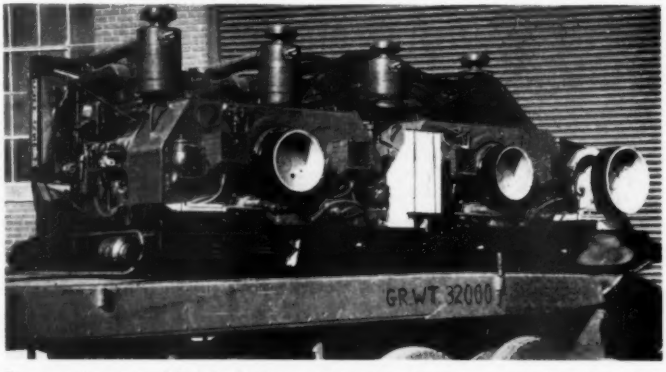
THE draw works and power section are mounted on truck-bed-height substructure 4 ft. below derrick floor on a 7,500-ft. company rig operated by Shell Oil Co. in northeastern Colorado. Popularity of this innovation has led two Rocky Mountain contractors to employ the same arrangement on rig layout in the Denver-Julesburg basin and the Uinta basin.

Rig revamped.—During 1950, Shell purchased a Model U-15 rig. It was equipped with two banks of Dual NH diesel hydraulic-coupling power units rated at 360 hp. maximum at 1,800 r.p.m. or 280 hp. continuous rating at 1,800 r.p.m. The 5-ft. substructure for draw works and power section was designed in two sections with a combined over-all length of 27 ft. With the derrick-floor section added, the length is 43 ft.

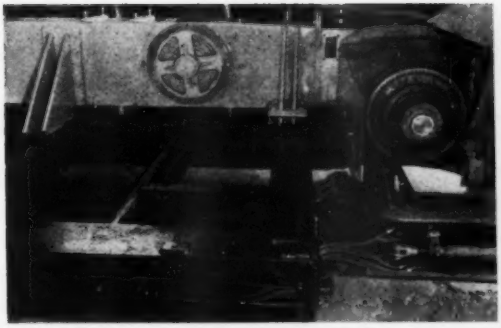
Engine skid frames were eliminated and the engines were set directly on draw works skid. Skid was modified for two sections with tapered-pin joint so that power section can be separated and moved separately if desired. However, the tapered-pin joint is strong enough to withstand



Final assembly-shop view of revamped rig showing compound and elevated cat line rollers.

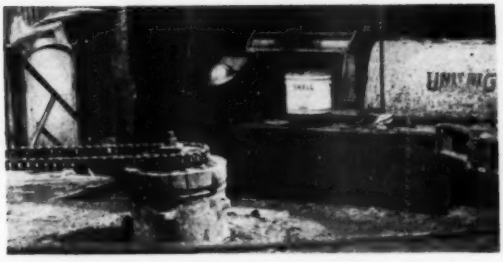


Power section on truck-bed for hauling; note two "hauling ends" mounted on tapered-pin skid joint for attaching winch line.

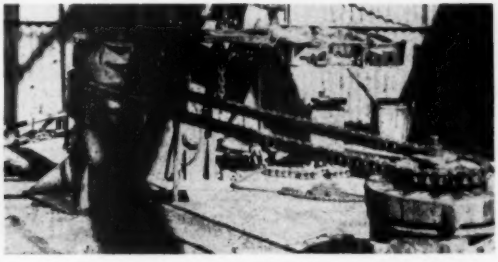


View of power-section skid with engine removed showing in foreground flange-type junction block for air lines; in background are special compound-mounting brackets for road clearance.

Cat-line roller addition used to attain height required on table floor; in addition, roller carries cat line horizontally over to well center; this holds true for both spinning line and breakout side.



View of driller showing step-down position of draw works.



View of chain drive from rotary table for digging rathole.

loading and hauling stresses in case separation is not desired. Special "hauling ends" are furnished to be attached to these tapered-pin joints for attaching winch line for hauling.

For easy hauling, the rig may be broken down into three components: draw works, power section, and compound. Compound is detached from power-section skid by special right-angle brackets to permit easy removal to meet road-width regulations. Accessories mounted on the compound case are 10-kw. generator, centrifugal wash-down pump, and oil pump for flood-type lubrication. The compound has independent feet to prevent drive from being damaged while hauling. A flange-type junction block, with O-ring-type seals are used to connect air line between skid sections.

Pump-drive changes.—Tail pipe is recessed on the double-pump drive, yet the skid ends are retained to protect mud-pump drive while loading. This permits close placement of mud pump to pump drive as well as placing of mud pump at a low angle beneath pump drive.

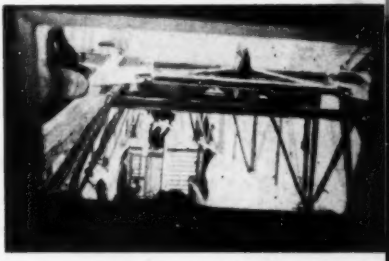
Derrick-floor substructure was modified to accommodate upper housing on rotary drive chain. This was necessary since rotary-drive sprocket on the draw works is actually lower than rotary table.

Due to step-down construction of substructure which places the draw works and driller 4 ft. below rotary table, cat line must be elevated to be at proper tong height.

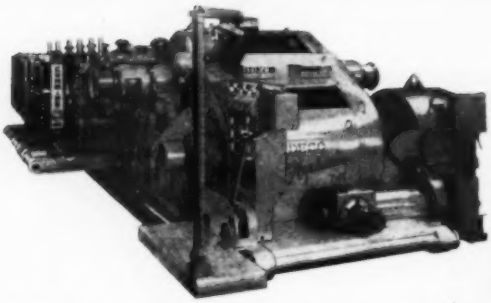
Driller is in advantageous position to watch rotary table and blowout preventers simultaneously. By means of a novel mirror arrangement, the driller can also observe derrick man rack drill pipe without having to look up into the derrick.

Drilling mast.—Rig is equipped with a 12-ft. cantilever-type portable drilling mast with a capacity equivalent to 325,000 lb. A.P.I. Platform capacity is 7,200 ft. of 4½-in. drill pipe in the right-side fingers. Leg spread is 13 ft. 7 in. at base.

Easy skidding of the complete rig is afforded by sliding two I-beams under substructure, loading on four Athey wagons, and moving with a couple of Caterpillars. Structure is complete with necessary reinforcing material to accommodate placing of I-beams.

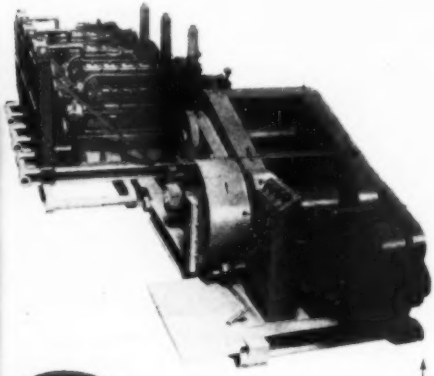


Mirror arrangement permits driller to watch derrick man and table simultaneously. Left: View from driller's position. Above: View of derrick-floor mirror from driller's position showing derrick man reaching for elevator.

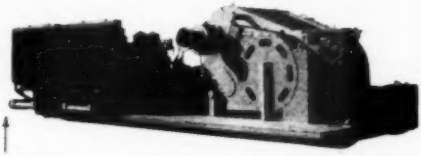


The *Hydrair* 7-11 . . . a torque converter equipped rig recommended for drilling to depths of 10,500 ft. with 4½" drill pipe when powered by engines developing a total of 1050 H.P.

IDECO Hydrair RIGS



All Hydrair Rigs are available in single and double drum models.

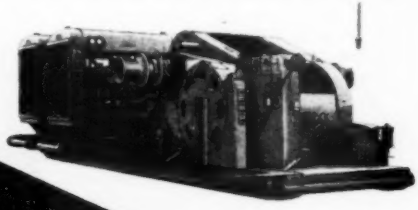


NEW

Available in torque converter and mechanical models H and M 750 series drilling rigs are recommended for drilling to 8,000 ft. with 4½" drill pipe when powered with two or three engines developing a total of 700 to 750 H.P.

The *Hydrair* H-525 . . . a torque converter equipped rig recommended for drilling to depths of 7,000 ft. with 4½" drill pipe when powered by two or three engines having a combined output of 500 to 600 H.P.

The *Hydrair* H-40 . . . a torque converter equipped rig recommended for drilling to depths of 6,500 ft. with 4½" drill pipe when powered with one or two engines developing a total of 400 H.P.



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AIR CONTROLS • AIR CLUTCHES

IDECO Hydrair rigs have been designed to obtain the maximum efficiency from hydraulic torque converter drives . . . air clutches . . . fingertip air controls.

A Division of Dresser Equipment Co.

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Only IDECO offers a complete line of field-proved rigs designed to obtain maximum efficiency from hydraulic converter drives combined with clutches and fingertip controls. *That's why* . . . wherever men drill for oil the trend is to the *Hydrair* line. This definite preference by drilling contractors has been won in the field by a record of fast, "maintenance free" operation . . . in the business office by a record of increased profits per contract. Compare the *Hydrair* line with competitive equipment . . . examine its "easy-to-service" design and many safety features. There is a *Hydrair* rig designed to fill your most exacting drilling or service requirement. Get all the facts . . . send for bulletin CC-51 today.

IDECO

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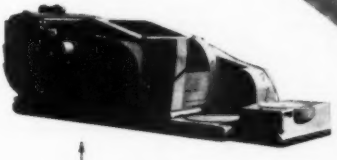
NEW

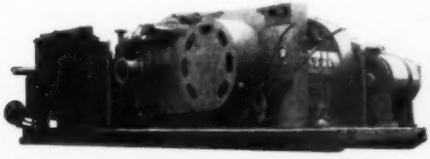
The *Hydrair* H-35 . . . a torque converter equipped rig for drilling to 5,000 ft. with 4½" drill pipe when powered by an engine developing a total of 350 H.P.

The H-35 is available in three models. H-35-S . . . a single drum drilling unit for wire line servicing to 13,500 ft. H-35-D . . . a double drum drilling unit for wire line servicing to a depth of 11,500 ft. H-35-DD . . . a double drum drilling unit for wire line servicing to a depth of 16,150 ft.



The *Hydrair* H-25 . . . a torque converter equipped rig recommended for drilling to 3,300 ft. with 4½" drill pipe and wire line servicing to 9,000 ft. when powered with an engine developing a total of 200 H.P.

The *Hydrair* H-30 is a torque converter equipped rig recommended for drilling to 4,500 ft. with 4½" drill pipe and wire line servicing to 10,000 ft. when powered with an engine developing a total of 310 H.P.



The *Hydrair* H-38 . . . a torque converter equipped rig recommended for workover to 6,000 ft. with 4½" drill pipe and for wire line servicing to 16,000 ft. when powered by an engine developing a total of 400 H.P.

The *Hydrair* H-20 . . . a torque converter equipped rig recommended for workover to 2,500 ft. with 4½" drill pipe, 4,900 ft. with 3" tubing, and for wire line servicing to 7,500 ft. when equipped with an engine developing a total of 200 H.P.

Left: Diesel-powered rig of Fitzpatrick Drilling Co., Casper, Wyo., working for British-American Oil Producing Co. "B"-2 Zigler, Yenter pool, Colorado. Right: Cable-tool mast of Rhoda-Cone Operating Co., Oklahoma City, used for completing British-American 2 Yenter.

How to Produce a Thin Oil Column

Well completions in high-permeability thin oil column solved by setting pipe through base of pay and perforating only middle foot; gas-oil and water-oil ratios controlled by this method

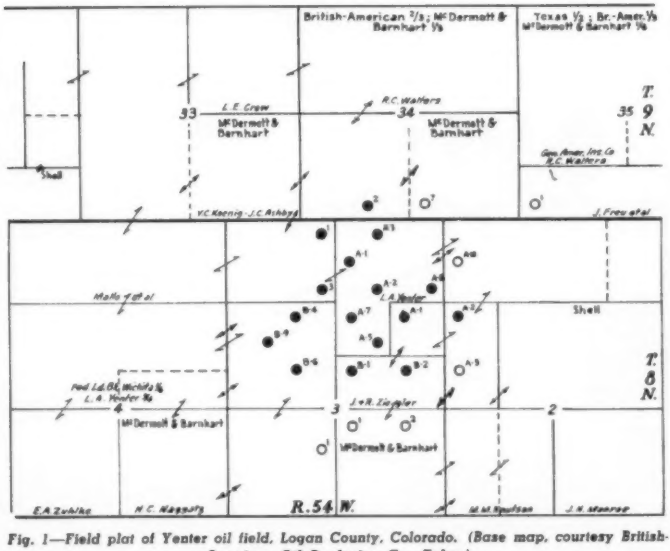


Fig. 1—Field plat of Yenter oil field, Logan County, Colorado. (Base map, courtesy British-American Oil Producing Co., Tulsa.)

EFFECTIVE control of gas-oil and oil-water ratios in highly permeable sandstone thin oil-column reservoir has been obtained by setting oil string through the pay and perforating only the middle foot. High vertical permeability (333 md.) affords access of reservoir fluids to the single-foot completion. Shot density is four bullets per foot.

Employed in Yenter field, Logan County, Colorado, by British-American Oil Producing Co., this supplants earlier practice of perforating as much as 6½ ft. Wells make the field "purchaser allowable" of 50 bbl. per well without difficulty.

Completion techniques.—Customary field practice at Yenter is to drill a field well to contract depth of about 5,350 ft. which is below the "J" sand oil-reservoir objective. Earlier, drill-stem tests are taken of the "D" and the "J" sands. Long string of 5½-in. pipe is set on bottom and the well plugged back to the base of the "J" sand.

In the "J" sand reservoirs operation of a water drive supplementing gas-cap expansion is suggested from the high producing efficiency obtained

to date. Bottom-hole pressures have dropped only slightly from the original reservoir pressure of 1,400 psi. since discovery; total reservoir withdrawal of oil has been 95,000 bbl. Reservoir characteristics are carried in detail in Table 1.

Reserve data.—Reservoir engineers estimate that 600 bbl. of oil per acre-foot will be recovered ultimately. Reserves are estimated at 11,000,000 bbl. for 18,300 oil-saturated acre-feet. The overlying gas cap is estimated to contain 5 billion standard cubic feet of gas in place.

Discovery well at Yenter was completed on December 1, 1950, by British-American 1 Koenig-Ashby, NE NE NW 3-8n-54w; it was completed for an initial production of 225 bbl. of oil per day from the "J" sand penetrated to a depth of 5,243 ft.

Producing rate is controlled by purchaser allowable of 50 bbl. per day per well. Currently, total field production is 950 bbl. per day from 19 wells; however, the field is capable of producing greatly in excess of this amount. Oil is moved by trucks to the Northport, Neb., station of Service Pipe Line Co.

Drilling activity.—Currently, there are three rigs active in the field, of which two are drilling for the account of British-American, the other for McDermott & Barnhart. Contractors working at Yenter include Pennant Drilling Co., of Denver; Fitzpatrick Drilling Co., of Casper, Wyo., and Herndon Drilling Co., Tulsa.

Drilling to the 5,200-ft. "J" sand is easy and holes are cut in from 10 to 15 days. Herndon cuts the first 4,000 ft. in from 2 to 3 days. A little trouble is encountered in keeping a straight hole and deviation has on occasion run as much as 4°.

Surface hole is 13¾-in. and at 217 ft. the 10¾-in. surface pipe is set and cemented with 175 sacks. At that point the hole is reduced to 8¾ or 7⅞-in. and open hole is carried to contract depth averaging 5,240 ft. Oil string of 5½-in. pipe is landed on bottom and cemented with 300 sacks.

Slush pump.—Standard practice in Logan County, Colorado, is to use a 7¼ by 18-in. slush pump working in the pressure range of from 550 to 600 psi. Under these conditions, penetration rates are fast in the soft Cretaceous shales. Only six bits are needed to reach the top of the Cretaceous starting under the surface pipe.

Following drill-stem tests of the "D" and "J" sands, pipe is run and set through the Graneros-Dakota alphabet sand series. Rotary rig is moved off and cable-tool mast rigged up to drill out part of the cement plug, gun perforate the casing, and swab in for completion.

Other applications.—Successful application of the single-foot gun-perforating method in a thin oil column has already found application in other "J" sand fields in Logan County, Colorado. In Cheyenne County, Nebraska, north of these fields, Ohio Oil Co. made a successful completion by this method in Dorman oil field. Its 2-A Elsasser, NW NW SW 24-14n-50w, flowed 157 bbl. of oil in 15 hours on preliminary flow test through casing perforations from 4,680-81 ft. with two holes in the "D" sand topped at 4,663 ft.

TABLE 1—RESERVOIR CHARACTERISTICS YENTER FIELD, LOGAN COUNTY, COLORADO

"D" Gas Reservoir	
Average depth, ft.	5,150
Average porosity, per cent	20.05
Average permeability, md.	340
Average connate water, per cent of pore space	42.35
"J" Sand Oil Reservoir	
Average producing depth, ft.	5,200
Gas-oil contact, ft.	—842
Oil-water contact, ft.	—858
Oil column, ft.	16
Average porosity, per cent	21
Average permeability, md.	333
Average connate water, per cent of pore space	20
Gravity of produced oil, °A.P.I.	37-39
Original reservoir pressure, psig.	1,400

TYPICAL WELL LOG—BRITISH-AMERICAN OIL PRODUCING CO.

Location: 330 ft. south of north line and 990 ft. west of east line Lot 10, Section 3-8n-54w, elevation 4,334 ft. K.b.

Schlumberger tops

	Ft.
Niobrara	4,240 (+94)
Greenhorn	4,800 (—466)
"D" sand	5,048 (—714)
"J" sand	5,148 (—814)
TD	5,200 (—866)

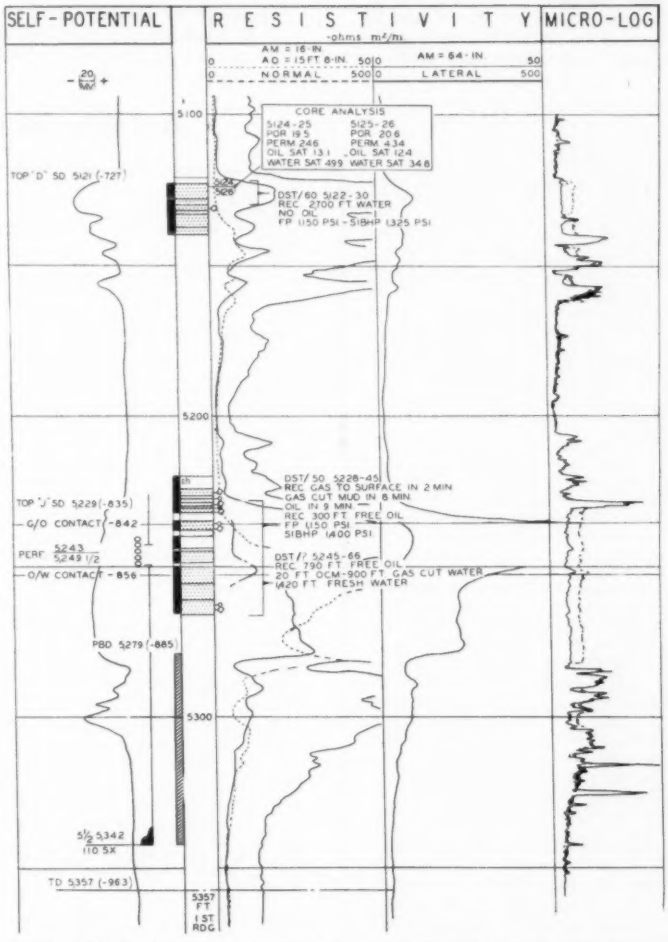


Fig. 2—Type electric log of pay-section detail for Yenter pool, Logan County, Colorado, showing formations extending from the top of the "D" gas sand down through the "J" sand oil reservoir. The well is British-American Oil Producing Co. 1-A Yenter, CWL NW NE 3-8n-54w, completed on January 3, 1951, for an initial production of 135 bbl. of 37.4°-gravity oil through casing perforations from 5,243-49½ ft. in the "J" sand. Mud resistivity is 0.8 ohms m_2/m. at 168° F., and electrode spacings are AM = 16-in., AO = 15-ft. 8-in., lateral AM = 64-in. Hole size is 7⅞-in.

What's Needed in Equipment?

Survey shows marked agreement among contractors as to what they would like to have in the way of new tools

Here are replies of rotary drilling contractors in various sections of the country on what they think are most notable improvements in drilling equipment, and what they'd like to see done further to improve the tools with which they work.

Here Are the Questions

1. What changes in drilling equipment have had the most profound influence?

2. In what way has subsurface drilling equipment been improved in recent years?

3. What in mud and mud practices has markedly helped in drilling operations?

4. What recent changes in compounds and prime movers are most important?

5. In what ways have drilling methods generally been improved and advanced?

6. What changes in equipment are needed further to improve drilling operations?

. . . And Here Are the Answers—By Areas

DRILLING contractors all over the country apparently think in the same manner about what has been done to improve drilling tools, and what is needed for improvement in the future. Of course, detailed recommendations vary somewhat from area to area because of special localized problems, but by and large there is general agreement. This is shown by the table below which summarizes results of a survey conducted by the American Association of Drilling Contractors.

This survey shows marked agreement with surveys conducted by widely spread industry organizations, notably the A.P.I. A study committee of the Gulf Coast district agrees with the A.A.O.D.C. that automatic drilling controls, hydraulic torque-converter drives particularly for small rigs, jet bits, and improved mud systems were outstanding developments in drilling in 1950.

It is apparent that the adaptation of the torque converter to drilling rigs of all kinds rates high on the desirable list. There is some argument that the high-torque-multiplication characteristics of the converter makes it undesirable in some respects for use with mud pumps but these objections are being overcome and the converter will undoubtedly be applied more and more.

The trend toward faster moves between holes is evidenced by contractors' desires for lighter, more portable equipment. Automatic drilling controls and other types of automatic control equipment are high on the "should be developed" list, and recently have received widespread application.

Mid-Continent

1

Quick-moving derricks. Development of fluid-drive drilling rigs and larger trouble-free gas engines. Almost complete replacement of older equipment with new, efficient, speedy, up-to-date machinery. Torque converter.

2

Tool joints that can take more wear before being rejected and new threads developed for these joints. Improved bit performance and life. Plastic coating and electrical inspection of tubular goods. Improvement of drill-collar metallurgy so long strings of collars can be used with comparative safety.

3

Intelligent application of chemicals to drilling fluid to develop high viscosity with minimum of natural mud weight, use of chemicals to develop low-water-loss fluids. High fluid velocity to increase penetration rate. Better quality mud through better knowledge of conditions. Advancement in drilling fluid that includes protection to contractor as well as to formation. Better methods of handling mud quality, enabling deep holes drilled without consuming great quantities of casing.

4

Air-actuated equipment. Torque converters. Lighter weight per horsepower in diesels. Recognition that reserve of power is a good thing. "Packaged" rigs—providing alignment, efficient lubrication. Diesel engines.

5

Control of mud. Use of more drill collars with less work for drill pipe. Use of heavier weights and better muds.

6

Torque converters. Improved bits. If possible lighter weight to do same job. A more compact lighter weight drilling rig with engine capacity of 1,000 hp. at slow speeds with controls that can be actuated to use of fluid or electric drive. Better bits which drill with less weight and/or stay on bottom longer. Better mud or means of conditioning holes.

Ark-La-Tex

1

Replacement of steam rigs by power rigs. Power rigs with lower operating costs. Air operation of draw-works controls. Building of diversified drilling rigs, notably development of mechanical rigs powered by internal-combustion engines. Improved power and transmission on power rigs, portability of equipment. Rigs for 20,000-ft. drilling.

2

Standard threads—better threads—better machine work for soft drilling, diamond core barrel and heads for all coring. Better engineered drilling bits as related to design, fluid velocities, tooth arrangement, materials; more hole with fewer bits. Long drill-collar string to increase weight on bit without unduly stressing drill pipe. Greater variety of bits giving high performance in different-type formations. Development of alloy drill pipe, improved tool joints, drill collars. Jet subs for rock bits.

3

Chemicals for treatment of drilling fluids. Bigger power pumps having larger input horsepower capacity used with 5-in. o.d. drill pipe which mean larger rates of circulation. Mud consciousness—technical and careful control of mud conditions. Acquiring knowledge by drilling crews on how to use drilling-fluid materials. Use of low-water-loss muds.

4

More compact, portable rigs. Fluid couplings and torque converters. Introduction of compact diesel-engine compounds with horsepower capacities up to 2,000. This allows for adequate horsepower at all times to flow in any direction. Air-operated clutches in conjunction with fluid couplings. Perfecting of power-transmission clutches, both direct and air controlled, as used on mechanical rigs.

5

More supervision and general efficiency. Use of better drilling fluids, better bits with larger drill pipe, bigger pumps with long drill-collar strings carrying up to 60,000 lb. on

. . . Drilling Contractors Voice Their Needs

bit with high circulation rates for faster penetration. Acceptance of low rotary speed and high drilling weight made possible by using drill collars. Over-all knowledge of drilling personnel. The use of right type of drilling fluid to suit drilling conditions.

6

Manufacturers should maintain better, larger stock of replacement parts. Better grade of drill pipe, tool joints. Generally less weight and lower cost in practically all equipment. Emphasis on design simplification, dependability in air-controlled rigs. Continued research to improve string and reduce weight of same. Cheaper equipment. A drilling rig that is flexible as to capacity so that it may be stripped down for competitive shallow drilling or added to for competitive deep drilling.

Permian Basin

1

Rock-bit improvements. Power drilling rigs, jack-knife derrick. Development of unitized rigs making them more portable, shortening rig-up time. Drilling weight controls, power slips. Better, larger, unitized drilling equipment, mechanical-engine drives. Perfection of power rigs. Development of drilling bits which can sustain heavy weight. Mud pumps, internal-combustion engines, draw works with compounds.

2

Improvement of rock bits, use of long strings of drill collars, placing the weight required on the bit and allowing drill pipe to be held in tension. Better drill pipe, tool joints, care of drilling string, steel in drill collars, improved type of connections on drill collars. Bits which can sustain heavy weight for drilling. Diamond coring.

3

Low-water-loss starch muds for control of salt. Better chemical muds and low-water-loss muds. Bigger and better pumps for higher pressures. More extensive use of water as a drilling fluid, steel mud tanks, where needed. Selection of proper casing points so that water can be used more extensively in drilling wells. Wider knowledge of mud treating.

4

Power rigs. Precision chain. Unitizing of draw works and chain drives. Fluid clutches. Change from V-belt to multiple-chain drives. Compounding engines, running them in tandem. Fluid couplings. Development of air controls, large friction clutches.

5

Heavyweight, long-collar-string technique. Power drilling rigs, jack-knife derrick, improvement of rock bits. Proper rotary speed. Over-all improvement in machinery; better educated, trained men. Drilling, diamond coring, percussion bit. Use of long strings of drill collars which impose loads of 6,000 to 7,000 lb. weight per inch at bit diameter. Controlled rotary speeds for drilling of exceptionally hard formations.

6

Large, reliable torque-converter rigs. Better drill pipe. Smaller engines with higher horsepower rating packaged for deeper drilling, smaller draw works with larger drums for more portable drilling of 10,000-ft. holes. New rock bits, requiring less weight on bit for fast penetration. Better drill collars, drill pipe, tool joints; something to enable the drilling of straighter holes. Simplification of mechanical rigs, radical improvements in steam equipment. Better drilling-fluid circulation systems originating at mud pump.

Gulf Coast

1

High-pressure, high-volume, power-driven pumps. Development of the rock bit. Jack-knife derricks. Jet bits—improved clutches. Power rigs—larger mud pumps with increased power output for both steam and power rigs. Changing over from steam to power equipment.

2

Improved drill-collar joints, flash-weld tool joints, multiple drill collars, 5-in. o.d. Drill pipe—jet-type bits. Hard metal bands on tool joints. Successful use of long strings of drill collars to get much longer service from drill pipe. Development of long-tooth rock bits for shale drilling.

3

Use of filtration control. Information about water loss, pH. Use of proper-type mud, mud-treating agents, such as caustic quebracho mud (red mud). Maintain adequate circulating rate. Use of larger pumps, knowledge gained from training programs.

4

Torque converters. Air clutches. Reduced the weight per horsepower. Development of hydraulic-drive applications. Development of heavy-duty air-actuated friction clutches, high-speed, low-speed diesel engines. Fluid coupling, adequate horsepower engines for heavy-duty work. Use of friction clutches and chain drives. Gas-butane engines.

5

Jet-bit-drilling techniques. Recognition, use of increased nozzle velocity of drilling fluid at the bit. Velocity. Use of sufficient drill collars to keep drill pipe in tension, permitting faster rates of penetration in hard formations. Better engineering in relation to drill stem; mud handling.

6

Constant straight-hole recorder. Attention should be given to new, better methods, techniques. Possibilities for improvement of present machinery, particularly in simplification. Reduction in weight of equipment without reduction in capacity. Increased efficiency of equipment. Better types of bits for drilling hard formations, automatic controls; better personnel. High-pressure, low-weight power-driven pumps. Lighter, cheaper rigs.

California

1

Rapid development, wide acceptance, use of spark-plug rigs. Mobile units. Development of highly portable blitz rig; power rig; power-driven rigs; improvement of internal-combustion-powered drilling machinery and drilling masts. Improved portability of drilling masts and machinery.

2

Improvement of rock bits. Lightweight drill tubing. Use of long strings of drill collars. Improvement of drilling bits, use of high-alloy drill pipe. Improvements made in steel for joints, drill collars, bits. Improvement has been made in drilling-bit tooth and circulating design.

3

Use of chemicals to control viscosity, water loss, circulation troubles. Oil-base muds for completion and workover. Accurate control of various properties of fluid affecting drilling. Development of larger pumps to increase volume and speed of circulation; greater volume; higher pressures. Knowledge drilling crews have acquired from mud schools. Introduction of new chemicals, other additives.

4

Development of torque converters. Use of torque converters and automatic transmissions and their application to light, high-speed diesels with high horsepower per pound of weight ratio. Development of diesel engines; air clutches and controls; dynamic brakes.

5

Longer strings of drill collars and higher rotating speeds. Drilling fluids. Drilling of exploratory slim holes. Ability to stay out of trouble mechanically by intensive study, use of correct drilling fluids. Slant-hole drilling under tidelands. Drilling-fluid control. Magnetic indicators, electrical devices to locate position of stuck drill pipe or casings. Locate position of drilling string lost in hole. Improvement in fishing tools, development of "shaped charge" to reduce bit cones or other hard material lost in bottom of holes. Inspection devices for determining condition of drill stem, tool joints, substitutes, and casing before use.

6

Lighter high-grade steel for lighter equipment able to withstand heavy use. Improved mobility—greater unitization—more capacity per pound. Use of light metal alloys in various parts of drilling rig to reduce aggregate weight. Reduction of weight would accelerate the drilling rate. Stronger, more durable internal-combustion engines. Lighter, stronger, more ductile pipe. Drill-collar connection. Circulating pumps. Brakes. Drilling-weight control instrument.

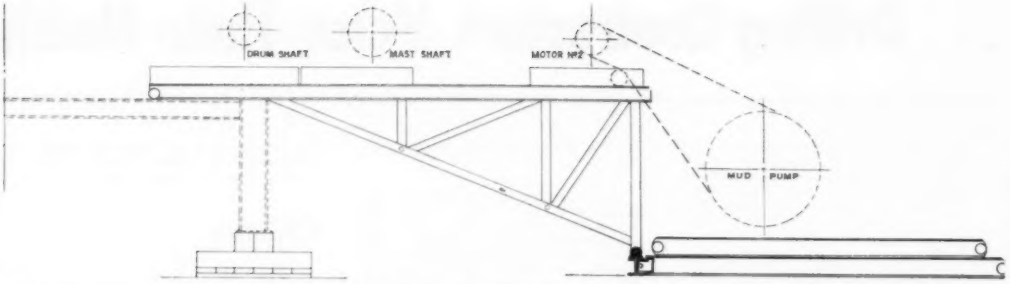


Fig. 1—Transverse section of new-type substructure showing single-plane truss-type support. Mud-pump skid shown at right is mounted on a horizontal steel ground-level extension of the substructure bolted by an I-beam to the vertical member.

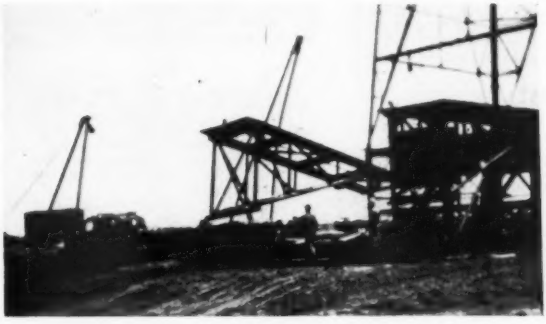


Fig. 2—Rigging operation showing crews hoisting substructure section into position; note lightweight construction.

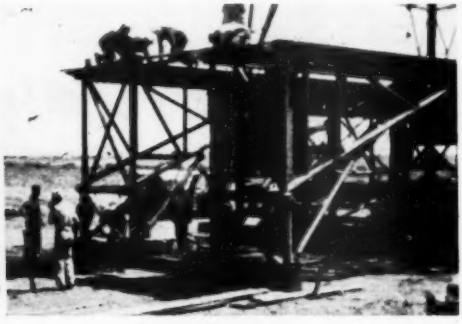


Fig. 3—With substructure members in position, steel-sill flooring is shown installed. Reinforcing construction is silhouetted.

New Truss-Type Engine Substructure

Lightweight support offers greater clearance, which speeds rigging up. Also, hauling costs are lowered. And new cradle-type pump mount eliminates long drive.

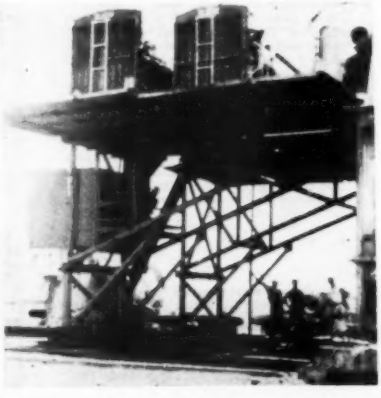
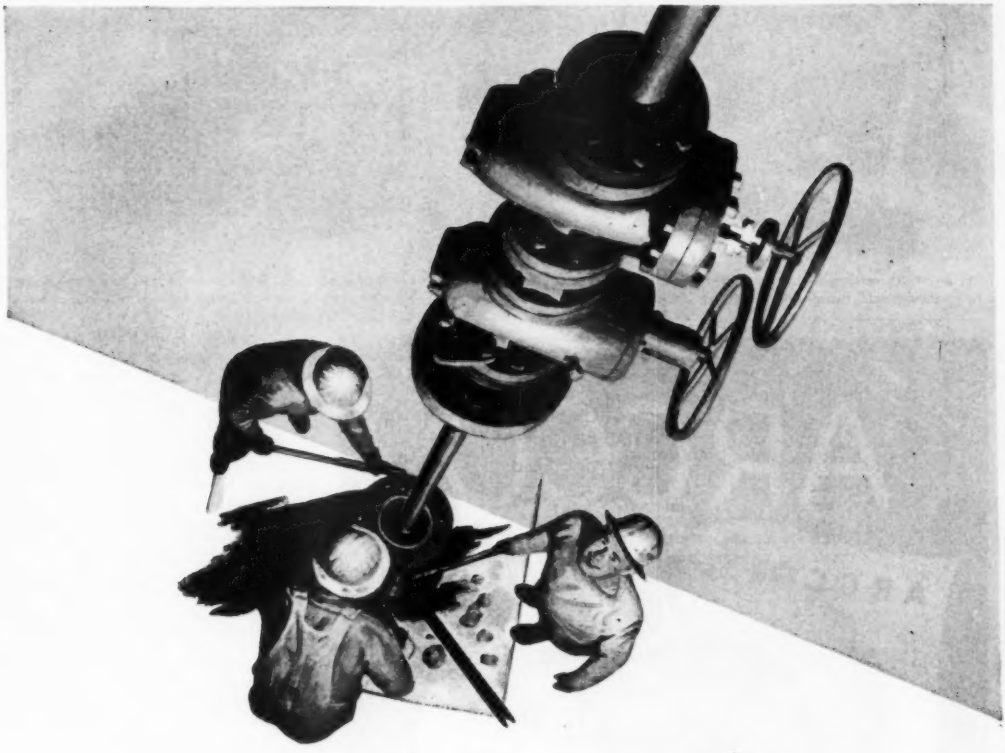


Fig. 4—(Left) Truck on reinforced wooden loading ramp is shown spotting draw works onto substructure. Fig. 5—(Right) View showing the two drilling engines in operating position on substructure.

A NEW truss-type engine substructure employing the principle of single-plane support has been developed by Kerr-McGee Oil Industries, Inc., Oklahoma City, a leading drilling contractor. Currently, the installation is in operation in the Northeast Mayfield (Hoxbar) field, Beckham County, Oklahoma, for Carter Oil Co. It is mounted at Kerr-McGee's rig on the 1 A. C. Wood, SE NW NW 4-10n-25w. This well is the diagonal southeast offset to the field discovery well, Carter 1 Garrett, SE SE SE 32-11n-25w.

Advantages cited by Kerr-McGee drilling department officials are: greater clearance, faster rigging-up time, and lighter construction which lowers hauling costs. A new cradle-type pump mount eliminates long belt-drive problems, maintains proper V-belt alignment and tension. An improved compound skid frame incorporates a removable frame rim section to permit installation of V-belt drives. (See Fig. 6).

Light weight.—Ease of rigging up is afforded by construction of the substructure in two equal sections joined by crossbeams (See Fig. 3).



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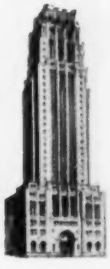

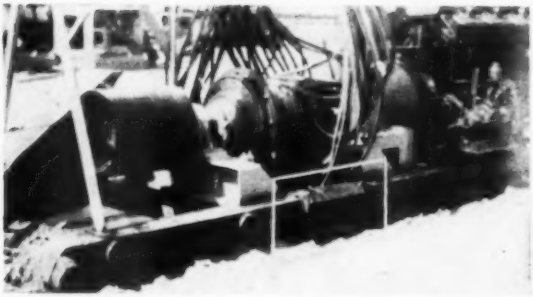

Fig. 6—White rectangle outlines removable bolt-jointed member of compound skid frame which permits easy rigging of V-belts.

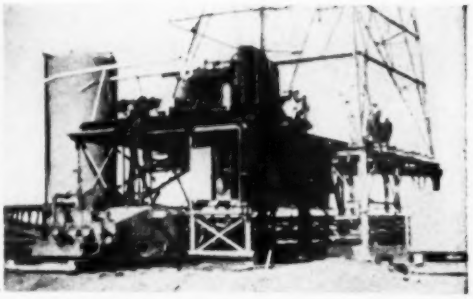

Fig. 7—Over-all view. Ground-level substructure extension permits close placement of mud pump to pump drive.

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The sections stand 14 ft. when erected. Either section is placed in position by a tandem-type truck as shown in Fig. 2. At the top, steel-flooring sills are bolted into position as in Fig. 3.

The rigging operation in Fig. 4 shows a tandem truck spotting draw works on the substructure. Note the reinforced wooden ramp upon which truck is backed up. The assembled substructure in Fig. 5 shows the two drilling engines in position.

Pump cradle.—A mud pump working off of the compound (See Fig. 1) is mounted on a ground-level cradle. The cradle is bolted to an I-beam at the base of the vertical member leading down from the substructure. This arrangement, with the idler, maintains proper V-belt alignment and tension. Its use permits close coupling and reduces whip.

Removable section.—The compound skid frame is modified to remove a section of the frame, to permit stringing of V-belts as shown in Fig. 6. After the V-belts are in place, the section is placed on the compound frame and rebolted. The bolting pin is in either double or quadruple shear.

Rig Description

Draw works.—Draw works shown in Fig. 4 comprises a T-645 Model 75. It is equipped with No. 3 A.P.I. rotary drive sprocket. Auxiliary brake is 36 in. Hoist is designed for 10,000-ft. drilling.

Drilling engines.—Two L-3,000 12-cylinder gas engines using 4-cylinder gas-starting equipment drive the hoist and a single drilling pump.

Compound.—A two-engine single-pump engine compound has a V-belt D-210 with 21-in. 17-D sheaves.

Drilling Pumps.—Two drilling pumps are a T-440 with 64-in. 16-D sheaves. A separately driven drilling pump powered by a third L-3,000 gas engine is a C-250 equipped with 56-in. 15-D sheaves.

BOOKS

MINERAL COMMODITIES OF CALIFORNIA. Bulletin 156 of the California Division of Mines, Ferry Building, San Francisco. 445 pp. 50 cents.

This volume presents the geological occurrence, economic development, and utilization of California's resources, embracing more than 80 types of raw materials of commercial and strategic importance. An attached map shows distribution of the state's mineral deposits.

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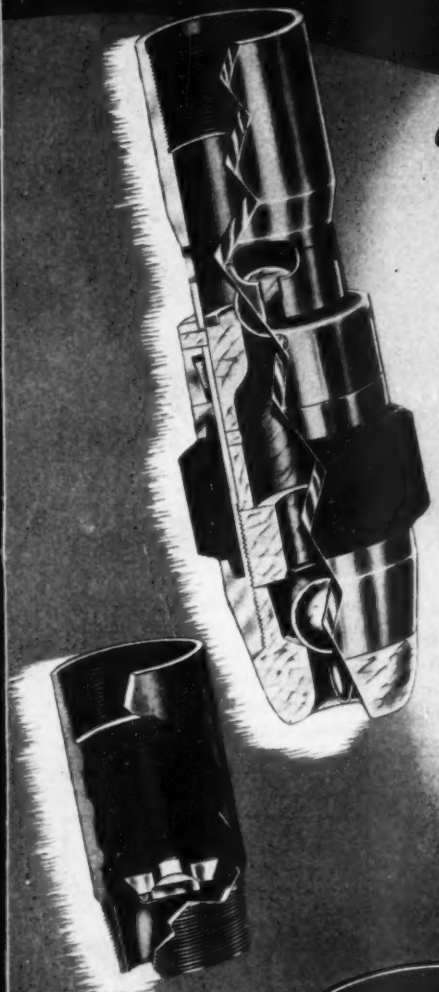

The risk of impaired productivity is ever-present when low-pressure permeable pay zones are left exposed to cement contamination while the casing is being cemented. Larkin Cementrol* equipment was specifically designed to eliminate this risk and has proved successful in thousands of applications.

ILLUSTRATED . . .

1. The Larkin Cementrol Float Shoe after the packing element has been expanded and the internal Bakelite bridge has moved down to expose the lateral cementing ports. (Cementrol equipment is actuated by a bridging ball pumped down from the surface after the casing has been landed.)

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BECAUSE drill pipe has to make many trips in and out of the hole, a pipe wiper is necessary. First, to clean slippery drilling mud from the pipe as it comes out of the hole... helping keep the derrick floor clean for workmen's safety. Second, wiping drilling mud from the pipe keeps costly drilling fluid *in* the hole where it belongs—prevents waste. Two savings at once!

It takes an out-of-the-ordinary material to make a successful pipe wiper. That's why Hycar rubber was chosen. For Hycar has top-notch resistance to oil, gas and abrasion. It won't deteriorate in contact with gas and oil contaminated drilling fluid.

What's more, Hycar stands up under severe wear and abrasion conditions. For example, when pulling pipe through the wiper, the body of the wiper is held against the bottom of the rotary table. When the pipe is spun to unscrew a joint, the wiper body spins right with the pipe. Here again, Hycar comes through a winner—withstands terrific punishment.

Hycar has many uses in oil field machinery and equipment. It resists oil, gas, heat, weather and wear—has many more advantages. It may help you develop or improve a product. At present, demand for Hycar exceeds supply. However, limited quantities are available for development work. For technical bulletins and advice, write Dept. HF-10, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco.

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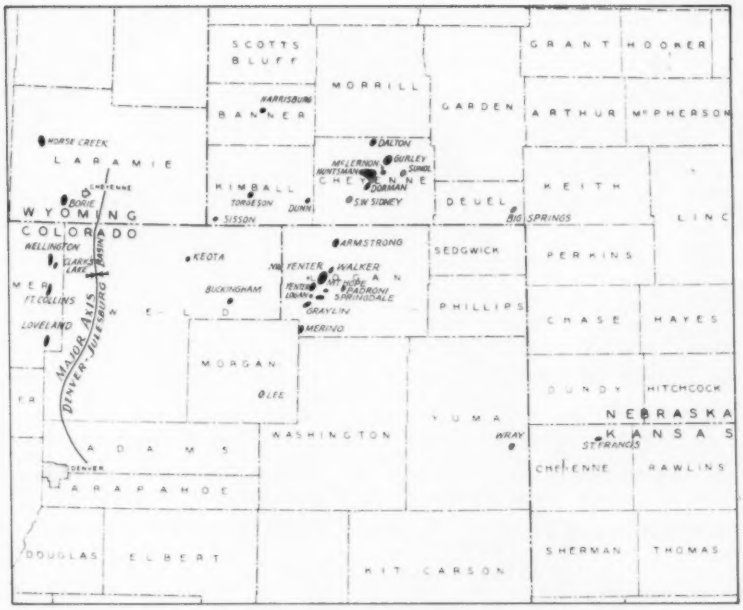

Fig. 1—Regional map of Denver-Julesburg basin showing location of oil and gas fields in southwestern Nebraska, northeastern Colorado, and southeastern Wyoming.

Fig. 2—Carter Oil Co. 1 Carl Nicholson, "J" oil well in the new Merino field.

Denver-Julesburg Basin Scene of Active Drilling, With 36 Rigs Operating

The tristate area of southwestern Nebraska, northeastern Colorado, and southeast Wyoming is producing 9,320 bbl. daily under purchaser restriction. The Dakota series is productive from 25 oil fields and 5 gas fields

by Joseph A. Kornfeld
Mid-Continent District Editor

WITH 25 oil fields and 5 gas fields on production after 2 years of limited development, the Denver-Julesburg basin lying on the front of the Rocky Mountains commands major interest in the drilling industry of the nation.

Currently, 38 rigs, operated by 25 contractors, are in operation throughout this basin extending through southwestern Nebraska, northeastern Colorado and southeastern Wyoming. These companies are headquartered in seven states including Colorado, Illinois, Kansas, Nebraska, Oklahoma, Texas, and Wyoming.

Daily production reaches an aggregate of 9,320 bbl. (restricted) from this tristate area sprawling over an area extending for a north-south distance of 125 miles lying on the east flank of a major Cretaceous basin. However, this represents only the total amount that can be handled by present facilities by crude-oil gatherers and purchasers. Completion of the Platte Pipe Line Co. line, which will pass through this basin, will enable purchasers greatly to increase the take from these fields and step up this amount by possibly an additional 15,000 bbl. daily from existing wells. Many of the wells are limited by purchaser allowable to only 50 bbl. per day.

Large Area: Several Pays

Depths to production range from as shallow as 3,200 ft. as in the West Big Springs gas field of Deuel County, Nebraska, on the northeast line of the basin. On the west side of the basin, 150 miles distant, the same formation — Dakota - Graneros — produces in Borie field, Laramie County, Wyoming, at a depth of 8,700 ft. In the intervening area lies a series of producing fields.

The Dakota-Graneros series of Upper Cretaceous age contains the present productive horizons; however, within this series, nearly all of the fields are producing from the Third or "J" sand. However, other potential reservoirs productive elsewhere in the Rocky Mountain region may be productive including the Lower Cretaceous sands, and the Pennsylvanian equivalents.

The purpose of this article is to analyze and review the drilling practices employed currently in developmental operations in the several portions of the basin. For simplicity, this article is divided into three major divisions: **Colorado Fields, Nebraska**

Fields, and **Wyoming Fields**. Treatment will be made in this order.

COLORADO FIELDS:

Merino Field

Background. — Largest producing area on the Colorado side of the Denver-Julesburg basin in daily production is Merino field located in the southwestern corner of Logan County. After slightly more than a year of development, the field has 10 wells on production with a combined production of 1,400 bbl. daily under purchaser allowable restriction. It is surpassed in daily output only by Huntsman field of Cheyenne County, Nebraska, which is currently producing about 1,600 bbl. daily under restriction.

Discovery well.—On a farmout from Ohio Oil Co., Trigood Oil Co. drilled the discovery well on July 30, 1950. It was 1 Couch, SE SE SE 19-6n-54w, completed for 247 bbl. of 38.6°-gravity oil on the pump with about 12 per cent water. Production was from the "J" sand logged from 5,095 to 5,112 ft.

This field is situated on an east-west trending anticline with exhibits 50 ft. of structural closure.

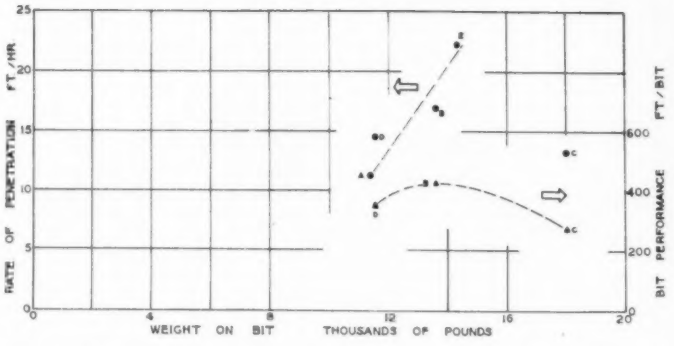

Fig. 3—Graph showing relationship between weight on bit and rate of penetration and bit performance.

Casing and cementing practices.—Surface string is 10¾-in. set at about 310 ft. and cemented with 200 sacks. Long string is 7-in. set through the

CASING AND CEMENTING PRACTICES IN OIL AND GAS FIELDS—DENVER-JULESBURG BASIN

OIL FIELDS

County, field, and discovery well—	Discovery date	Prod. wells 8-1-51	Average gravity A.P.I.	Producing zone Name	Producing zone Depth	Surface casing Size (in.)	Surface casing Seat (ft.)	Surface casing Cement (sacks)	Oil string Size (in.)	Oil string Seat (ft.)	Oil string Cement (sacks)
COLORADO:											
Logan:											
Armstrong—British-American 1 Segelke	6- 9-50	1	40	J	5,406	10¾	600	150	7	5,775	250
Merino—Trigood Oil Co. 1 Couch	7-30-50	13	38.6	J	5,095	10¾	311	150	7	5,160	150
Mount Hope—Shell Oil Co. 1 Green	11- 9-50	19	38	D	4,866	8⅝	369	200	5½	5,338	250
Walker—British-American 1 Green	8-22-50	1	37	J	4,982	10¾	241	150	7	5,348	250
Yenter—British-American 1 Koenig-Ashby	12-14-50	19	38	J	5,240	10¾	208	175	7	5,243	250
Graylin—British-American 1 Monroe	5-10-51	5	37	D	4,896	9⅝	210	140	5½	5,097	150
S. Yenter—Plains Exploration 1 Dalke	7-18-51	1	36.7	J	5,222	10¾	268	215	5½	5,300	250
N.W. Yenter—British-American 1 Arford	6-18-51	1	38	J	5,289	9⅝	217	140	5½	5,375	250
Springdale—Shell Oil Co. 1-B State	8-25-51	1		J	4,884	8⅝	471	200	5½	4,969	200
Morgan:											
Lee—Denver Basin Oil Co. 2 Lee	7-16-50	2	39.4	D	5,440	10¾	100	150	5½	5,478	250
Weld:											
Buckingham—Shell Oil Co. 1 Hanson	11-15-50	2	38.7	D	6,710	8⅝	823	400	5½	6,871	300
Keota—Wycolo 1 Gillette	8-20-51	1	39	Muddy	7,322	10¾	250	400	5½	7,403	400
NEBRASKA:											
Cheyenne:											
Gurley—Ohio Oil Co. 1 Egging	8-10-49	15; 1	36.1	D; J	4,429	10¾	300	285	7	4,900	300
Huntsman—Ohio 1 A. L. Cruise		18; 2		D; J	4,618	10¾	451	285	7	4,931	300
McLernon—Ohio 1 J. M. McLernon	5-15-50	4	37.7	D	4,490	10¾	235	145	7	4,500	200
Dorman—Ginther et al 1 Dorman	7-18-50	13		D, G	4,686	10¾	444	285	7	4,700	285
Reimers—Ohio 1 Reimers	8- 9-51	1		J	4,796	10¾	210	150	7	4,900	300
Dalton—Recco Oil Co. 1 Foy	2- 5-51	1		J	4,740	10¾	200		5½	4,966	250
Marlowe—Ohio 1 W. A. Sparks	4-28-51	1		G	4,567	10¾	214	140	7	4,695	200
Banner:											
Harrisburg—Stanolind, Phillips, Kerr-McGee 1 Downer	2-17-51	4	35	J	5,876	10¾	504	265	7	5,878	250
Kimball:											
Torgeson—Nebraska Drillers 1 Torgeson		1		J		13⅜	246	265	7	6,525	250
Sisson—Gulf 1 Sisson	8-28-51	1	38	J	7,333	13⅜	567	575	7	7,431	270
Wytex—Wytex & Derby 1 Dunn	8-20-51	1	37	J	5,660	10¾	460	400	7	5,780	250
WYOMING:											
Larimer:											
Borie—The California Co. 1 Morton King	8- 5-49	5	38.4	Muddy	8,542	10¾	591	457	7	8,749	375
Horse Creek—General Pet. Corp. 4-280 Govt.	7- 9-48	25		Muddy	5,420	9⅝	1,200	175	5½	5,530	250

GAS FIELDS

County, field, and discovery well—	Discovery date	Prod. wells 8-1-51	Average gravity A.P.I.	Producing zone Name	Producing zone Depth	Surface casing Size (in.)	Surface casing Seat (ft.)	Surface casing Cement (sacks)	Oil string Size (in.)	Oil string Seat (ft.)	Oil string Cement (sacks)
COLORADO:											
Adams:											
Little Beaver Creek—Orin Tucker 1 Hough	5- 1-51	1		D	5,188	10¾	70		5½	5,560	200
Logan:											
Padroni—The Texas Co. 1 D. E. Gould	7-14-51	1		J	4,625	10¾	209	180	5½	4,750	250
Morgan:											
Lee—J. M. Huber 1 Govt.-Smith	10-15-50	1		D, J	5,442	10¾	200	150	5½	5,536	200
NEBRASKA:											
Cheyenne:											
Sunol—Ohio Oil Co. 1 Fender	10-30-50	1		D	4,350	10¾	425	300	5½	4,400	300
Southwest Sidney—McCauley-Dorough 1 Anderson	10-25-50	1		D	4,660	10¾	400	300	5½	4,700	300
West Sidney—Ohio Oil Co. 1 State	12-30-50	1		D	4,802	10¾	450	300	5½	4,900	300
Huntsman—Ohio Oil Co. 1 O. Mather	2- 1-50	8		J	4,740	10¾	449	285	7	4,905	300
Deuel:											
Big Springs—Ideal Drlg. Co. 2 Bosley	10- 1-50	4		J	3,288	10¾	322	225	7	3,380	150

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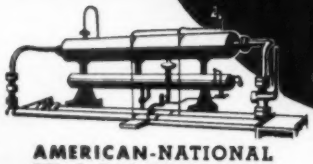

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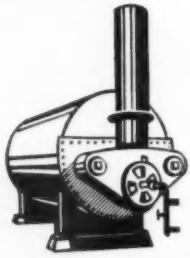

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"J" sand and cemented with 150 sacks. Gun-perforating practice is six shots per foot.

Operators participating in development of this field include Carter Oil Co., Ohio Oil Co., and Trigood.

Buckingham Field

Company rig.—First oil producer for Shell Oil Co. in the Denver-Julesburg basin was completed on November 16, 1950, in the Buckingham area of Weld County using a company rig. Its 1 H. A. Hanson, NE NE NE 33-8n-59w, was first drilled to a total depth of 7,254 ft. in the Morrison formation, then plugged back and completed in the first or "D" sand topped at 6,707 ft. Long string of 5½-in. pipe was set at 6,871 ft. and casing perforated from 6,710-22 ft. with four shots per foot. Initial production was about 35 bbl. of oil per day.

Diagonal southeast offset was completed about March 1, 1951, at the company's 1 Castor, SW NW NW 34-8n-59w. The well was drilled to a total depth of 6,722 ft. The 5½-in. pipe was set at 6,700 ft. In an open-hole completion, the well was shot with 1½ jets per foot from 6,706-12 ft. It bailed ½ bbl. of oil per hour for 3 hours.

Hydrafrac treatment.—Following Hydrafrac treatment, the well swabbed 186 bbl. of oil and no water in 14 hours; placed on the pump it made 105 bbl. of oil per day.

CASING AND CEMENTING PRACTICES, BUCKINGHAM FIELD ("D" SAND OIL RESERVOIR, SHELL OIL)

Inch—	1 Hanson	1 Castor
$8^{5}/_{8}$	823 ft. (400 sks.)	370 ft. (200 sks.)
$5^{1}/_{2}$	6,871 ft. (300 sks.)	6,700 ft. (100 sks.)

NEBRASKA FIELDS:

Cheyenne County

Drilling thick Cretaceous shale sections in the Denver-Julesburg basin brought some drilling problems early in the development of the basin fields. However, by determination of optimum bit weight, proper mud control, correct slush-pump size, and use of full-hole reaming these penetration problems were minimized.

Mud conditioning.—Ohio Oil Co. first attempted to treat the drilling fluids to maintain average operating viscosity with a minimum water loss in development of its fields near Sidney in Cheyenne County, Nebraska. According to R. W. McCanne, assistant manager, Rocky Mountain division, Ohio Oil Co., this method brought about serious walling up of the hole which resulted in an abnormal amount of stuck drill pipe. Ohio's experience indicated that the best procedure was to use straight bentonite material and water solution held as nearly as possible to 35 seconds Marsh funnel viscosity and 155 cc. water loss.

Full-hole reaming effect.—Common practice in the Sidney area has been to obtain a full-hole reaming effect by standing back the pipe and pulling the bit back to the top of the formation after each 100 ft. of penetration, then running pipe back to bottom to drill ahead. Adoption of this procedure has always left the hole in excellent condition for coring and testing. Enlargement of bit nozzles has assisted greatly in lowering down time due to walling up of the hole.

Jet drilling.—An outstanding penetration rate by jet drilling was the record of a two-cone jet which drilled 5,929 ft. of section in 54 hours of rotating time, this penetration rate was in excess of 100 ft. per hour. Moreover when the bit was pulled, the hole was still in good condition.

Casing and cementing.—Normal practice of Ohio Oil is to drill a 15-in. hole to a depth of about 300 ft.,

Other articles by the author covering current drilling practices and modern equipment used in development of new producing areas appear on page 234, 238, 242, 273, 288, 292, and 299 of this issue. The material was collected via a number of trips to the operating centers and interviews with many drilling contractors and operating superintendents.

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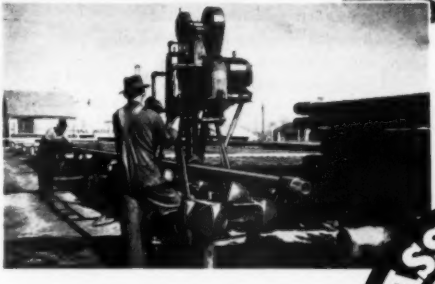

(*Left*) Returned pipe is straightened, repaired to first class condition and threads properly lubricated before being replaced on racks.

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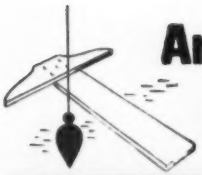

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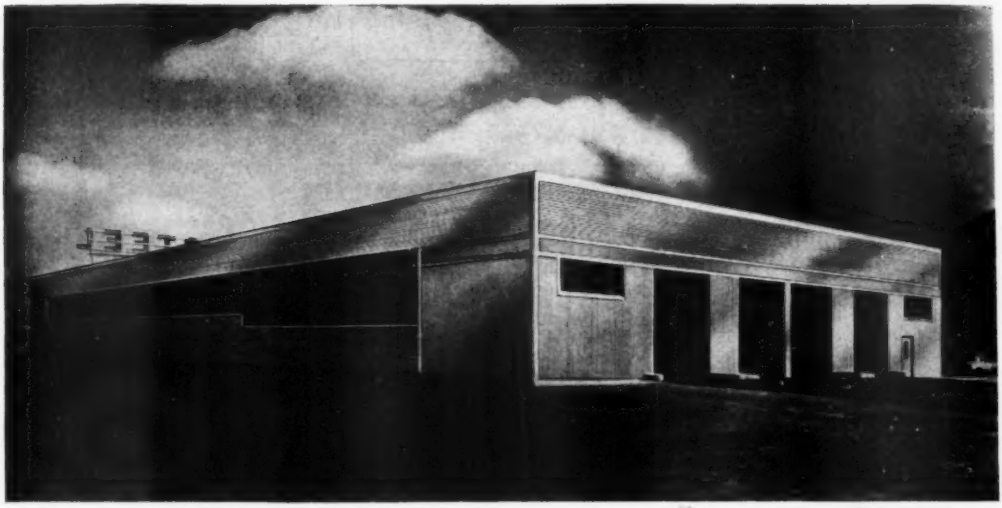

New warehouse—Ward Steel Co., North Cambridge, Mass.

When the Ward Steel Company of North Cambridge, Mass., undertook to build the most modern steel warehouse in New England, they called on Waghorne-Brown as designers and engineers. Waghorne-Brown specified rustproof, corrosion-resistant Reynolds *Lifetime* Aluminum Industrial Corrugated for siding. Their reasons were: appearance, long life, low initial cost and low maintenance (no painting)... plus great strength combined with light weight that saves money on framing (see specifications).

Aluminum's radiant heat reflectivity was another deciding factor. On walls or roof, it reduces inside summer temperatures and cuts winter fuel bills. An interesting detail in this building is the contrasting horizontal and vertical application, with aluminum corners and edging. For technical assistance and application details, call any Reynolds Office. Literature on request.

• Offices in principal cities... check your classified phone book for our Building Products listing, or write Reynolds Metals Company, Building Products Division, 2005 South Ninth St., Louisville 1, Ky.

Specifications for Reynolds *Lifetime* Aluminum Industrial Corrugated:

Thickness .032"
Corrugations 7/8" deep, 2-2/3" crown to crown
Uniform load support (roof) 80 p.s.f. on 4' purlin spacing
Uniform wind load capacity (siding) 20 p.s.f. on girt spacings up to 7'9"
Roofing width 35", coverage 32"
Siding width 33-3/4", coverage 32"
Lengths 5', 6', 7', 8', 9', 10', 11', 12'

Aluminum is required for planes and other military needs. Reynolds *Lifetime* Aluminum Industrial Corrugated is still produced, but the total supply is necessarily reduced. DO-rated orders receive priority handling.

REYNOLDS *Lifetime* ALUMINUM INDUSTRIAL CORRUGATED

then cement a string of 300 ft. of 10¾-in. casing. Only 12 hours is required for drilling and casing time on the surface string. Waiting-on-cement time varies from 18 to 36 hours.

From that point, a 9-in. hole is cut to coring point; this level is generally 20 ft. above the projected top of the First or "D" sand of the Dakota-Graneros group; this lies in the Gulfian or Upper Cretaceous series.

Wire-line coring equipment is used with a 7⅝-in. core bit. Sands are cored in 5 or 10-ft. sections in the "D," "G," and "J" sands.

Double packers are used in connection with drill-stem testing in rathole; one is used at the zone to be tested and the other at a level 8 ft. above the first packer setting. Regardless of wall conditions, this method has proved generally satisfactory.

General completion method employed by Ohio Oil in Cheyenne County is to set and cement long string through the lowest pay zone, perforated both above and below pay zone, squeeze to obtain proper shut-off, and then rerun perforator to complete selectively. Shot density employed is generally four shots per foot.

Following production perforations, tubing is run, drilling fluid is displaced with crude oil or water, and the well then swabbed into production.

Harrisburg Field

The most northerly field in the basin is Harrisburg field lying in Banner County, southwestern Nebraska. Stanolind Oil and Gas Co. conducted an extensive lease play early in 1950 throughout the basin, and more than 2½ million acres was leased in Nebraska, eastern Colorado, and southeastern Wyoming. On the Nebraska side of the basin an extensive seismic campaign was conducted; however, Stanolind drilled three wildcat failures in the northern portion of the basin.

Kerr-McGee Oil Industries, Inc., joined with Stanolind and drilled two wildcat failures on Stanolind blocks. The third well, in which Phillips Petroleum Co. joined, was the discovery well: it was 1 Downer, NE NE SE 6-18n-55w. The "J" sand objective was topped at 5,878 ft.; on final completion gage, the well pumped 323 bbl. of oil per day.

Operations of the well were acquired by Stanolind and development carried on by this firm.

Drilling practices.—Drilling in the field is not complicated. Penetration rates are high. Principal problems have been related to balancing of surface equipment, determination of optimum weight on bit, proper drill-collar program and arrangement, optimum pump-liner size, and proper mud program.

An interesting correlation between weight on bit and rates of penetration and bit performance for a group

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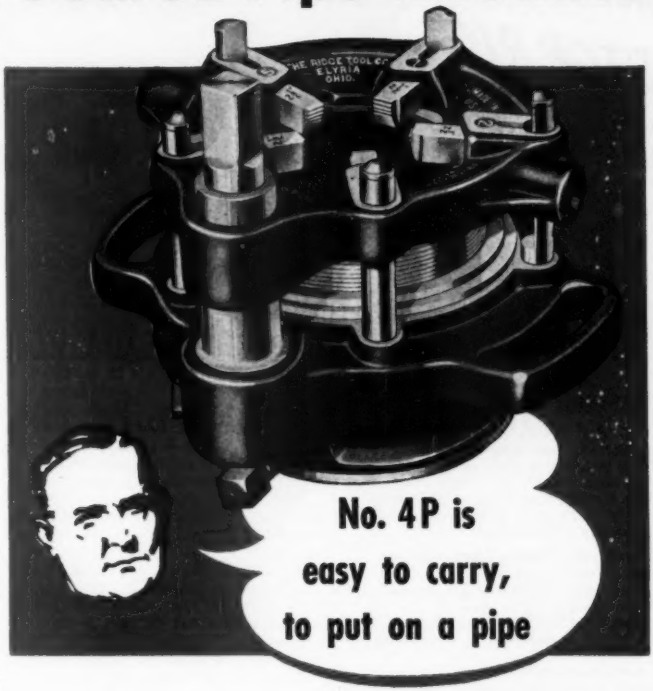

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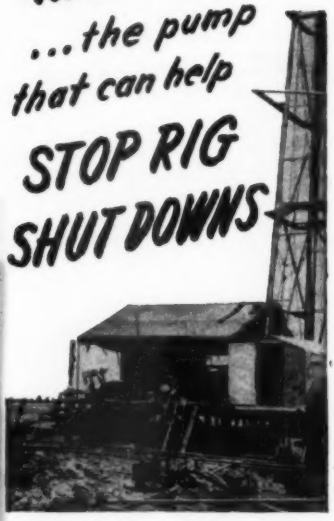

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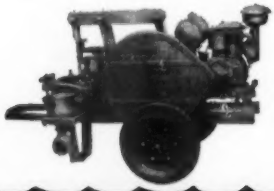

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TABLE 1—CORRELATION OF DRILLING PRACTICES, HARRISBURG FIELD, BANNER COUNTY, COLORADO

Item—	A	B	C	D	E
1. Completion date	12-9-50	6-3-51	3-26-51	5-3-51	6-3-51
2. Rate of penetration, ft./hr.	11.2	16.8	13.2	14.4	22.2
3. Weight on bit, lb.	11,400	13,500	18,000	11,570	14,300
4. Weight on bit per inch of diam.	1,267	1,510	2,000	1,280	1,590
5. Weight of drill collars, lb.	11,706	18,000	21,500	13,050	13,930
6. Weight on bit/drill collar wt.	0.97	0.76	0.84	0.88	1.03
7. Pump pressure, psig.	518	616	725	534	535
8. Mud volume circulated, g.p.m.	322	385	418	438	415
9. Annular velocity, ft./min.	130	158	170	176	173
10. Rotary speed, r.p.m.	86	108	71	107	119
11. Maximum deviation and depth	1° at 4,489	1° at 4,681	1½° at 3,615	1¾° at 3,493	2° at 3,966
12. Mud weight, lb./gal.	10.0	10.5	9.7	9.6	10.1
13. Viscosity, sec. A.P.I.	45	47	50	....	....
14. Total depth, ft.	6,659	5,907	6,498	6,186	6,659
15. Total number of bits	....	14	24	18	....
16. Average ft. per bit	....	422	270	243	....

Legend:
A—Kerr-McGee 1 State-Lovercheck, NE NE NW 16-18n-55w. B—Kerr-McGee 1 Downer, SE NE NE 6-18n-55w. C—Kerr-McGee 1 T. D. Lovercheck, C SW SE 17-18n-55w. D—Kerr-McGee 1 H. A. Downer, C NW SW 5-18n-55w. E—Kerr-McGee 2 W. W. Downer, C SW NE 6-18n-55w.

of five wells in the field is shown in Fig. 3. This chart shows that the highest rate of penetration, 22.2 ft. per hour, were obtained when the weight on bit was in the order of 14,000 lb. as shown in Well C. At this high rate of penetration, the hole remained straight and maximum deviation was only 1½° at 3,615 ft. Moreover, bit performance measured in feet per bit was at a peak at the 14,000-lb. weight. Tabular data from which the graph was prepared are carried in Table 1.

Casing and cementing program.—Surface pipe used on 1 H. A. Downer, C NW SW 5-18n-55w, employed 610 ft. of 10¾-in. 40-lb. J-55 pipe cemented with 350 sacks. Long string was 5,982 ft. of 7-in. 20-lb. and 23-lb. mixed string; 200 sacks of cement were placed behind the pipe.

Drill-collar practice.—Standard drill-collar practice in this field is to carry 5¾-in. by 30-ft. at the top and two of this size at the bottom. Only one collar failure was experienced in five wells drilled in this area. A box cracked at the base of the threads on 1 Downer, SE NE NE 6-18n-55w; a new box was shrunk on the collar at a machine shop at Casper, Wyo.

Diamond coring.—Standard diamond coring practice in the basin is to use a 6⅛-in. o.d. core head. From one to two diamond cores are taken in the "J" sand series logged at about 5,880 ft. Earlier, a limited amount of conventional coring with a 7½-in. o.d. core head was conducted, but this has been supplanted by diamond coring.

TABLE 2—FORMATION TOPS, HARRISBURG FIELD, BANNER COUNTY, NEBRASKA

(Kerr-McGee Oil Industries, Inc., and Standolind Oil & Gas Co. 1 T. D. Lovercheck, NE NE NW 16-18n-55w. Electric log determinations. Surface elev.: 4,850 k.b.)

Formation—	Depth
Lance	747 (+4,103)
Pierre shale	1,254 (+3,596)
Niobrara	5,203 (— 353)
Fort Hays lime	5,445 (— 595)
Carlile shale	5,573 (— 723)
Greenhorn lime	5,727 (— 877)
Graneros	5,780 (— 930)
"D" sand	6,071 (—1,221)
"J" sand	6,205 (—1,355)
Cloverly	6,417 (—1,567)

WYOMING FIELDS:

Borie Field

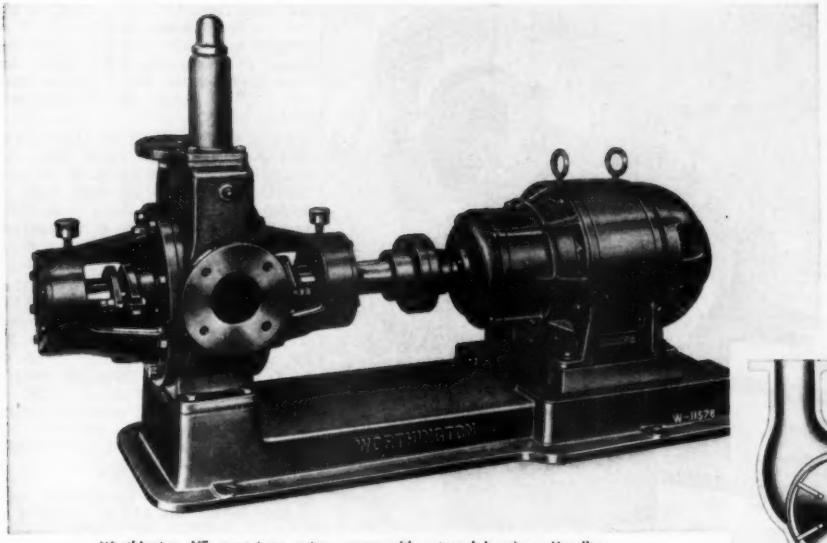
Few drilling problems are encountered in Borie field of Larimer County, Southeast Wyoming. Drilling through the thick soft Cretaceous shales is easy. Very little trouble was encountered in keeping hole straight; maximum deviation was 3½° at 7,739 ft. Lost time on the fourth oil well in this field amounted to only 3.11 days or slightly more than 4 per cent of a total of 73.91 days, total rig time. Over-all penetration rates averaged 12 ft. per hour for this 8,749-ft. well at The California Co. 1 Wyoming-State, SE NE SW 24-13n-68w. Days to drill totaled 58 from spudding to total depth. In-and-out time totaled 78 days.

Rig equipment.—One major drilling contractor has employed the popular "75" draw works. Its Rig 28 was driven by a 12-cylinder L-3,000 gas-butane drilling engine rated at 832 hp. Derrick was 129 by 24 ft. with 537,000-lb. rating; substructure is 7 ft. 3 in. A single 7¾ by 20-in. mud pump was employed.

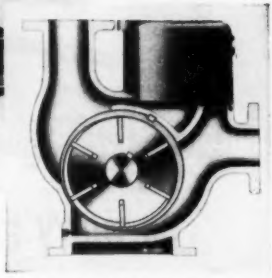
The other rig, No. 3, has mounted on it a 136 by 26-ft. derrick with a rated capacity of 537,000 lb. Substructure is also 7 ft. 3 in. Draw works is driven by two 12-cylinder and one 8-cylinder engines compounded for a total of 1,110 hp. Slush pumps are a 18-P 7¼ by 18-in. and a C-250 7¼ by 15-in.

Drilling practices: from 0-4,433 ft.—Using Rig 3, the first 4,433 ft. of hole was cut fast, at a penetration rate averaging 37.8 ft. per hour representing 117 hours of actual time on bottom. Only 11 bits were used or an average of 142 ft. per bit. In spite of this fast penetration rate, drilling was straight and most of the hole was cut at a deviation of not greater than 2°. Table speed averaged 120 r.p.m. Pump pressure ranged between 450 to 550 psi. and pump speed was 45 s.p.m.

From 4,433-7,400 ft.—Penetration rates in this section dropped to an average of only 11 ft. per hour. Bit performance in this section averaged 157 ft. per bit or 19 bits for the interval of 2,967 ft. Table speed was



Worthington VE vane-type rotary pump with external bearings. Handles non-lubricating fluids, including water. Also, volatile liquids, without danger of fire.



Cross-sectional drawing of Worthington vane-type rotary.

This heavy-duty rotary handles non-lubricating fluids with low cost for maintenance

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Many Advantages for Vane-Type Pumps

high displacement per revolution • smooth, non-pulsating flow • high suction lift • minimum number of parts • only one rotating element • vanes automatically compensate for wear.

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cut back from 110 to 78 r.p.m. in the section from 5,480 to 6,749 ft. Mud weight was held at 9.8 lb. and viscosity at 38 seconds A.P.I. Liner size was changed on No. 1 pump from 6¾ to 6-in. while No. 2 liner was 7¼-in.

From 6,749 to 7,400-ft. table speed was increased to 90 r.p.m. Mud viscosity was stepped up to 43 seconds A.P.I. Weight on bit was held at 25,000 lb. For the section from 7,400 to 8,330 ft. mud weight was increased to 9.9 lb. per gal. and viscosity increased to 46 seconds A.P.I.

Diamond coring. — A 6⅛-in. diamond core head was run from 8,715 to 8,795½ ft. In this interval, mud weight was increased from 9.1 to 9.4 lb. per gal. and viscosity from 68 to 75 seconds A.P.I. However, weight on bit was reduced from 21,000 to 10,000 lb. Additional diamond coring was done from 8,795½ to 8,846½ ft. with a 6½-in. core head, with weight on bit held at 10,000 lb.

TABLE 3—DRILLING PROCESSES RECORD, BORIE OIL FIELD, LARAMIE COUNTY, WYOMING

(The California Co. 1 Wyoming-State, SE SE SW 24-13n-68w. Contractor: Kerr-McGee Oil Industries, Inc.)

Hole Size: 9-In.

Rate of penetration, ft. per hour	20.0
Weight on bit, lb.	20,000
Weight on bit ÷ in. of diameter	2,200
Weight of drill collars	14,200
Weight of bit ÷ drill collar weight	1.4
Pump pressure, psig.	624
Mud volume circulated, g.p.m.	403
Annular velocity, ft. per min.	210
Rotary speed	98
Maximum deviation, deg.	3½
Point of maximum deviation, ft.	7,739
Mud weight, lb. per gal.	9.6
Mud viscosity, sec. A.P.I.	39

TABLE 4—FORMATION RECORD, SAME WELL

(Electric-log determinations; surface elevation: 6,535 ft. k.b.)

Formation—	Depth
Second Hygiene	4,094 (+2,441)
Niobrara	7,813 (—1,278)
Timpas	8,087 (—1,552)
Codell	8,111 (—1,576)
Muddy	8,764 (—2,229)
Total depth	8,749 (—2,214)

Horse Creek Field, Wyoming

On the northwest flank of the Denver-Julesburg basin but in southeastern Wyoming, two contract rigs are running for General Petroleum Corp., Los Angeles. Objective is the Muddy sand logged at about 5,580 ft. depending upon structural position.

Casing and cementing program.— Surface pipe is 9⅝ or 8⅝-in. whichever is available; this string is set from 1,185 to 1,361 ft. About 175 sacks are set behind the surface pipe. The long string is 5½-in. pipe set at 5,530 to 5,630 ft. and cemented with 250 sacks. In-and-out time on 34-6-P, in SW SE NW 6-16n-68w, was 19 days.

Completion method. — In contrast with the set - through - and - perforate practice employed on the gentle eastern flank of the Denver-Julesburg basin, General Petroleum sets the

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TYPE "JUS" HIGH PRESSURE STRIPPER
Incorporates slip and bowl with packing gland.

Both types made for 2", 2½" or 3" tubing.
Also may be used for 1", 1¼" and 1½" macaroni strings.
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  —"JUS" with slips
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- Rubbers can be changed without taking stripper from well head!
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Pioneered by Farris Engineering Corp., BalanSeal, as thousands of installations are proving, is ideally suited for use wherever a collecting system is required for a series of safety-relief valves. It permits higher downstream pressure with consequent smaller piping—a feature which often permits savings in piping costs as high as 15 times the cost of the valves. The sole force opposing the opening of the valve is the spring. Static or surge downstream back pressure cannot affect the disc and has no effect on the relieving point.

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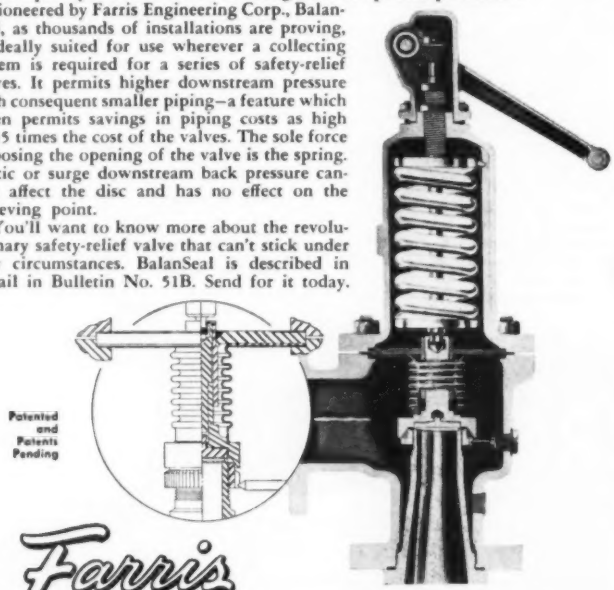

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long string on top of the Muddy and drills in with cable tools.

THE OIL AND GAS JOURNAL SURVEY OF DRILLING CONTRACTORS WORKING IN DENVER-JULESBURG BASIN

(Southwestern Nebraska, Northeastern Colorado, and Southeastern Wyoming)

State, contractor and address—	No. rigs
COLORADO:	
Anschutz Drilling Co., Wichita	1
Big Chief Drilling Co., Okla. City	1
B. B. Carter, Bridgeport, Neb.	1
Colorado Wyoming Drlg. Co., Denver	1
Denver Basin Drilling Co.	2
Falcon-Seaboard Drilling Co., Tulsa	1
Fitzpatrick Drlg. Co., Casper, Wyo.	2
Frontier Drilling Co., Denver	1
George & Wrather Drilling Co., Mt. Carmel, Ill.	1
Herndon Drilling Co., Tulsa	3
Will I. Lewis, Mt. Vernon, Ill.	1
McDannald Oil Co., Houston	1
Miracle & Fifer Drilling Co.	1
Olds Oil Corp., Casper, Wyo.	1
Pennant Drilling Co., Denver	1
Reserve Drilling Co., Casper, Wyo.	1
Service Drilling Co., Tulsa	2
Sterling Drilling Co., Sterling, Kans.	1
Suhr Fiderand Locke	1
Subtotal Colorado	24
NEBRASKA:	
Anschutz Drilling Co., Wichita	2
Earl K. Carey, Denver	1
B. B. Carter, Bridgeport, Neb.	1
Kerr-McGee Oil Industries, Inc., Okla. City	1
Miracle-Fifer Drilling Co.	1
Nebraska Drillers	1
R. C. Patton, Wichita	1
Service Drilling Co., Tulsa	1
Subtotal Nebraska	9
WYOMING:	
Kerr-McGee Oil Industries, Inc., Okla. City	1
R. L. Manning, Denver	2
Subtotal Wyoming	3
Total Denver-Julesburg basin	36

DAILY PRODUCTION STATUS DENVER-JULESBURG BASIN FIELDS

(Southwestern Nebraska, Northeastern Colorado, and Southeastern Wyoming)

(For week ended August 25, 1951)

	Daily avg.
COLORADO:	
Armstrong	10
Boulder	18
Buckingham	100
Fort Collins	100
Graylin	250
Greasewood	50
Lee	50
Merino	1,400
Mount Hope	600
Walter	100
Yenter	1,150
Subtotal Colorado	3,820
NEBRASKA:	
Dorman	650
Gurley	1,000
Harrisburg	200
Huntsman	1,600
Johnson	250
Marlowe	50
McLernon	250
Subtotal western Nebraska	4,000
WYOMING:	
Borie	350
Horse Creek	1,150
Subtotal Wyoming	1,500
Grand total Denver-Julesburg	9,320

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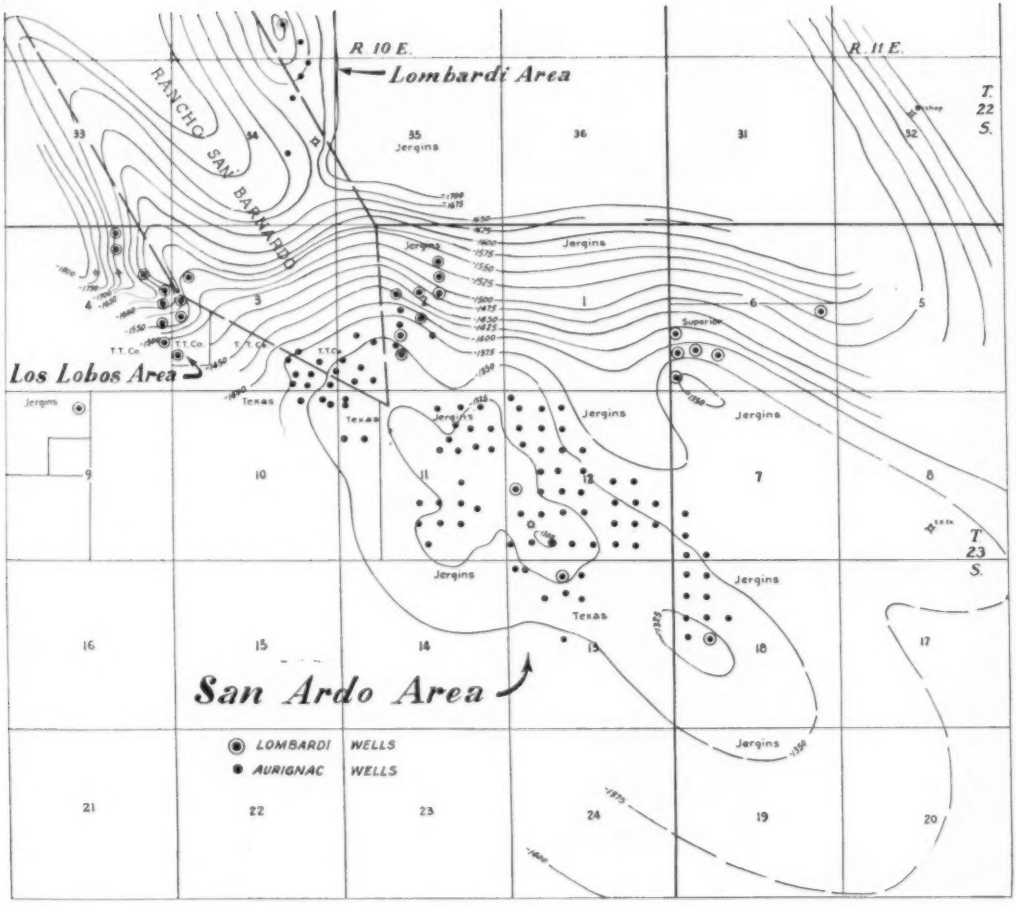

Map of San Ardo, California, area showing contours on top of Lombardi sand, the field's principal pay. About 150 producers have been drilled to date and as many as 200 more may be required to completely develop the field.

California's San Ardo Field Again Active

Improvement in heavy-fuels situation prompts resumption of extensive development

by D. H. Stormont
West Coast District Editor

OF California's shallower fields, San Ardo in the Salinas Valley area of Monterey County ranks among the top in number of proved or semi-proved undrilled locations. Believed to have a productive area of almost 3,500 acres, nearly 200 more wells will be required to complete its development on 10-acre spacing.

Discovered in November 1947, San Ardo had 60 producers by mid-1949. Then because of an oversupply of heavy crudes and residual fuels on the West Coast, drilling came to a standstill. Lacking a pipe-line outlet, about two-thirds of the completed wells were shut in during the remainder of 1949 and nearly all of last year.

Improvement in the heavy-fuels situation caused a few wells to be reopened beginning last November. Not until April, however, when it was announced the field would be given a pipe-line outlet, was extensive development again undertaken. Since then about eight rigs have been kept at work, either on development wells or on nearby wildcats. Total number of producers by late August was near the 150 mark.

Field details.—San Ardo's discovery well was in the Lombardi area (in 27-22s-10e) north of the area shown on the accompanying map. Located on a small, separate anticline

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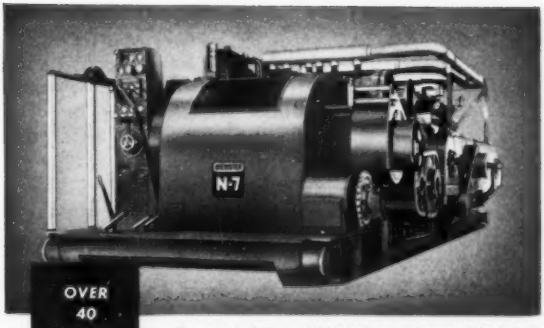

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it cored 25 ft. of saturated Lombardi sand at 2,133-58 ft. Five other wells, which like the discovery were drilled by The Texas Co., found only 30 to 60 ft. of saturation. Because of the thin section found, no further drilling has taken place there.

The Campbell area, which has proved to be the major structure, was discovered 3 years ago by Jergins Oil Co. 15 Orradre (labeled D on map). Subsequent development has shown the structure to consist of a broad anticline with the thickness of the Lombardi sand being about 250 ft. Underlain by a tilted water table which rises to the southeast, the oil-saturated portion of this sand ranges from about 225 ft. to less than 30 ft. in some portions. For the developed portion of the structure, average thickness of the Lombardi oil sand is almost 200 ft.

Drilling on the flanks resulted in the discovery of a second oil sand 55 ft. below the regular Lombardi sand. Designated the Aurignac (or Orradre) sand, it is found at about 2,500 ft.

As shown on the map, Aurignac production has been established on the northwest, north, and northeast flanks of the structure. In those areas the saturated section averages about 100 ft. thick but the lower 40 ft. or so is of low porosity and permeability. Lombardi producers well up on structure and in the southeast portion also have found the Aurignac present.

Both producing zones are in the Monterey group (upper Miocene) which lies on the highly eroded granitic basement. The Aurignac lies directly above the basement and is separated from the Lombardi zone by a 55-ft. siltstone bed.

Drilling Practices

In drilling San Ardo wells some 500 to 1,000 ft. of Pleistocene sand, gravel, and sandy clay are encountered, followed by 750-850 ft. of clayey sand and siltstones. Below these lie from 300 to 500 ft. silty and shaly sandstones (Santa Margarita) and then 100 to 300 ft. of Monterey siltstones, silty sands, and shales are encountered before the top of the Lombardi is picked up. Representing relatively easy digging, only four to seven bits are required and wells are completed in a total time of about 8 days. All drilling is on a contract basis.

In drilling both Lombardi and Aurignac wells, from 100 to 200 ft. of 11¾-in. surface pipe is set. The general practice is to run an 8⅝-in. water string on Lombardi wells and 7-in. on Aurignac producers. About 225 sacks of cementing material are used in setting this casing, consisting of a 1 to 1 mix of cement and lightweight materials with the last 50 sacks being quick-setting neat cement.

In drilling to the top of the pay, principal problem encountered is lost

Light rigs with portable masts such as shown here are used in San Ardo drilling. Only about 1 week is required for completing the 1,800 to 2,500-ft. wells.

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Because of sticky nature of heavy San Ardo crude, a boiler installation is a part of every tank battery. Steam is circulated to coils housed in the tanks, and in most cases is injected into 1½-in. lines placed inside 4-in. field lines.

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circulation. In the Los Lobos area on the northwest edge of the field the problem is particularly acute at about 1,300 ft. At the several wells drilled in the Salinas River bed much difficulty has been had from lost circulation in drilling the surface sands. There the practice is not to set surface pipe until these thief formations can be cased off. Use of lost-circulation materials of various types, coupled with proper control of mud, generally is sufficient to restore mud circulation in other cases.

Well completions.—After the water string is set and cement plug drilled out, the jel-base mud used in the upper part of the hole is replaced with an oil-base or lime-Impermex fluid. Depending on the depth to the water table at the particular well, and whether it is in the gas-cap area, 30 to 100 ft. of penetration is made in the oil zone. This hole then is scraped to 16 in. in Lombardi wells and a 6⅝-in. flow-packed liner set. On Aurignac wells the hole is enlarged to 13 in. and a 5-in. flow-packed liner used.

Because of the tendency of producers to water cone, Lombardi wells are completed as far above the water table as possible. As mentioned earlier the water table is tilted and rises to the southeast. This is borne out by the following record of subsea depths at which water was found in various producers: Well A (see map) found water at —1,717 ft., B and C at —1,563 ft., D at about —1,500 ft., and E at —1,425 ft. Control in particular areas is gained through carrying an occasional well to basement.

Future Drilling

While San Ardo now has pipe-line outlet of possibly 20,000 bbl. daily capacity, the sticky 12°-gravity crude produced more or less precludes any rapid development. For the remainder of the year it is believed the field's three operators, The Texas Co., Jergins, and Superior Oil Co., will continue to add a total of 15 to 20 new producers monthly.

As shown by the contour map of the top of the Lombardi, and keeping in mind the tilted water table, it would appear that well over 100 addi-

tional Lombardi producers can be drilled on the top and flanks of the main structure. At the southeast end Jergins 116 Hamby (Well E) found the Lombardi high (—1,320 ft.) but also found the Lombardi water table at —1,425 ft. Thus development should not extend too much further to the southeast.

A factor which will have a bearing on the extent of drilling is the effectiveness of the water drive. Because of the high viscosity of Lombardi crude (around 1,000 seconds S.F. at 140° F.) it is generally believed recoveries under primary methods will not exceed 15 per cent. Some engineers have placed it closer to 10 per cent. Thus even though porosities average about 25 per cent and permeabilities range to 3,000 md. and higher, a fairly thick pay section probably will be required to effect a payout. Reserves of the whole field have been variously estimated to range from a low of 75,000,000 bbl. to more than 200,000,000 bbl.

As in the Lombardi area, no further development of the Los Lobos structure is planned at this time. In Section 6 where Superior has six Aurignac producers, the Lombardi pay is wet and because of the low permeability and porosity of the Aurignac pay not much development is expected in the immediate future.

Jergins has adopted a program of drilling alternate Lombardi and Aurignac producers on the north flank of the structure (Section 2), and has completed some good Aurignac producers on farther north where the Lombardi is mostly below water. Wells carried through the Aurignac in NE Section 11 and SW Section 12 have found more than 100 ft. of this oil sand present. No development of the Aurignac in these two areas is planned at this time, however.

BOOKS

REFERENCE BOOK ON INSTRUMENTS FOR ELECTROLYSIS, CORROSION, AND CATHODIC PROTECTION TESTING. Published by American Gas Association, 420 Lexington Avenue, New York. $1.50.

This book contains 48 pages of text on characteristics and use of corrosion instruments and testing equipment, and also includes manufacturers' catalog sheets showing current models of instruments for electrolysis, corrosion, and cathodic protection testing.

THE STORY OF OIL. By G. W. Auxier, K.C. Published by Western Canada Petroleum Association, Calgary, Alberta. 68 pp.

This booklet was prepared for western Canadians interested in learning something about the oil industry, but, as Canadian operations do not differ from those in the United States, the material in this book is an excellent teacher for a layman of either country. In a completely nontechnical manner it discusses the origin of oil. It tells of the history of oil and the methods used to explore for it. One chapter explains who owns oil rights. How wells are drilled, brought in, and produced are described in such a way that a clear picture can be obtained by the uninformed. The booklet goes on through transporting, refining, and marketing of crude oil, tells how crude and products are priced, and how oil developments are financed.

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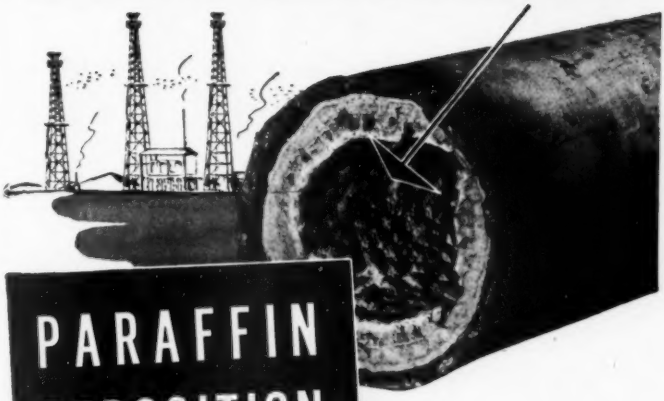

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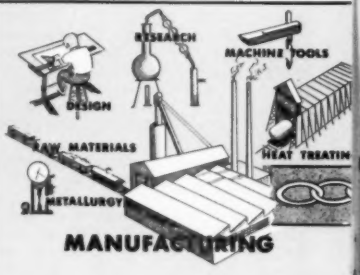
IN DRILLING AND PRODUCING OPERATIONS

First of a series of articles on subject of "Oil-Equipment Manufacture and Supply," especially prepared as an industry service by The Oil and Gas Journal.



FIRST STEP, before drilling and producing, starts at this point. Here the drilling rigs and flowing and pumping equipment are designed, tested, manufactured.

THE SUPPLY STORE

EVERY drilling contractor and oil producer has a partner without whom he could scarcely run his business, a partner whom he usually takes for granted because he is always right there on the job.

This partner is the supply-store and service-company man.

The supply-store and service-company man could hardly be called a silent partner, because he is very much in evidence, but he acts as a partner, because he gives advice and assistance on every tough drilling job, every completion and production question, and every problem of procurement and maintenance of oil-field equipment.

When the supply-store man or the service-company man calls at the running rig of a drilling contractor or the producing lease of an independent producer he brings the latest information on the tools and methods developed by the research organizations of the equipment manufacturers and the well-service companies. And very often this information is just as valuable as the supply store's more visible service of stocking everything the operator needs from a screwdriver to a complete drilling rig.

Big major companies might be able to get along without the supply stores—though none of them try it altogether. But the independent operator would be lost without them. Without a supply store handy, the driller or producer would have to be in the warehousing business himself, would have to carry large stocks of items he needs for operating and maintenance, and order them from scores of manufacturers scattered all over the country.

But that's not all. If the supply store were nothing but a supply store—just a warehouse for a lot of hardware—it might be a silent partner of the driller and producer, but not a very active or satisfactory partner.

It is the supply store's lack of silence which makes it a good partner. It sends its men out to the jobs, not just to "take orders" but to help with problems, give technical advice, and pass on the latest information on new methods and equipment.

To find out how this partnership is working, The Oil and Gas Journal interviewed representative people on both ends of the deal. First we asked several drilling contractors how they like the arrangement.

"Take me, for instance," replied one contractor. "I'm a 100 per cent supply-store man. I depend on the supply company for all my equipment, engineering services, and much advice. I think the petroleum industry as a whole more or less depends on the supply companies in carrying out its work.

"When I move into a new area I'm always anxious to see a supply-store fellow. I guess you could say that the drilling contractor is the biggest 'over-the-counter' buyer from the supply store."

The same thought was echoed by another driller, who said:

"Most drilling contractors and independent operators depend entirely upon the supply companies for our equipment and materials problems. We take our needs to the drilling-equipment sales engineer, and as another of his many services he offers us the proper assistance in solving our problems.

"Our supply-store representative calls on us at each rig every day. In fact, many of the representatives of these stores drive as much as 3,000 to 4,000 miles every month calling on us and other contractors.

"They make regular service calls and inspect our equipment and keep it in good running order without any charge to us for routine checks. Even when we have rigs in remote locations, 100 miles or more away from the supply store, the supply representative makes our rigs at least twice a week."

"Are there any real advantages in dealing through a supply store?" one typical drilling contractor was asked.

"Well," he said, "most of us think there are tremendous advantages in dealing with our supply stores.

"In the first place, we don't have to have a lot of capital tied up in stock. The supply company saves us this money, which we can put to better advantage. The supply man gives us better service, offers us engineering and technical advice, is always on the job ready with help, and even handles our claims."

"What about those claims?"

"Well, we drilling contractors always contact our supply store when we find a piece of equipment defective. The supply companies are always willing and anxious to expedite these claims for us. They want us satisfied, and they know that the manufacturer wants to have a satisfactory transaction. The supply man processes our claims as a part of his regular service."

"As a drilling contractor, you use a lot of equipment. Do you think it has improved much in recent years?"

"Definitely yes—all along the line. Manufacturers of oil-field equipment have done a splendid job in producing better equipment and making constant improvements.

"This is brought out by the fact that contractors can now make hole faster. Increased efficiency brought about by better equipment is one of the contributing factors in enabling us to stay in business, because we're getting the same prices today for drilling a well that we got a number of years ago."

SECOND STEP is distribution. Supply stores-service companies are of immense utility, real economy, to the the industry. Literally a "powerhouse" backing up drillers-producers.

THIRD STEP is the technical assistance provided by the supply-service companies. The field engineers . . . and thousands are employed by supply-service companies . . . have one motto, "Help the Customer!"

FINAL STEP—Good equipment pays off! With drilling-production demands at all-time highs, costs increasing . . . Today more than ever this maxim applies in the oil fields.

AND SERVICE COMPANY SERVE AS INDISPENSABLE LINKS IN A CHAIN

SINCE drilling contractors to a man seemed enthusiastic about this oil-field partnership arrangement, the Journal put a similar set of questions to a number of supply-store men.

They, too, like the partnership. But they have some problems, and most of them were anything but silent about these.

In the first place, we found all of them very proud of the service they give the oil industry, but some of them thought that, because of competition, they may be "spoiling" the operators.

"The customer is being babied to the nth degree these days," was the way one of them put it. "A lot of times our customers forget the boundary between service and impracticability. They downright take advantage of us sometimes."

On the whole, though, the real complaints were few and were generally laughed off as part of competitive enterprise and good customer relations.

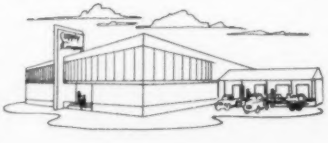
There is real competition in this business. There are more than 50 supply companies, not counting small service shops, and they operate a total of more than 1,000 supply stores throughout the oil regions of the United States. About half of these stores are maintained by the six or eight largest supply companies which carry the most complete, integrated lines and render the most varied service to drillers and producers. Some of the larger ones carry material for refineries and pipe lines, but most supply stores confine their inventories to equipment for drilling and producing.

The supply-store segment of the petroleum industry is really big business. Some of the modern, centralized stores in active areas might have an inventory of close to $3,000,000, where complete rigs and much other expensive equipment are stocked, and such a store might have around $100,000 invested in buildings, cars, trucks, and other facilities, and employ upwards of 50 men.

A more representative store would have a building and yard investment of around $40,000, about a dozen employes, and an inventory worth a quarter to a half million dollars. A recent survey made by the Petroleum Equipment Suppliers Association showed that the average inventory of all supply stores, large and small, is about $150,000, but a representative store in a reasonably active area would carry a considerable larger stock.

Carrying this big inventory load is one of the biggest, but by no means the only, service the supply store gives the oil operator. If every driller and producer had to stock his own supplies and maintenance parts, and deal directly with hundreds of manufacturers, his cost for materials would be considerably higher.

Supply-store men are quite positive on this point. They have made studies—and so have some of the major oil companies — which show that the expense of warehousing represents about 30 per cent of the total cost of materials and supplies delivered to point of use. By performing the functions of warehousing and distribution, the supply store saves the operator much of this cost. There is a markup, of course, but the supply men insist that their margins are fair and reasonable and that they pass on to the operators the bulk of the economic savings of centralized warehousing.



NOTHING exactly like the oil-field supply store exists in any other industry, though there are many counterparts in wholesaling and service functions performed for other trades. The supply store is the connecting link between manufacturer and user, but the oil trade universally considers the supply store a very essential and useful link in the chain.

"If you ask a hundred oil men what a supply store does," one supply man remarked, "you would probably get a hundred different answers, because supply stores do many things for many people.

"Talk to a drilling contractor or independent producer who is just getting started in busineess, and he will tell you that a supply-store connection is a 'must.' For him it represents not only a dependable source for his equipment, but also a credit connection that will protect him if the development must be carried on at a higher level than he can finance at the time.

"Then, too, he can get advice and help on his engineering problems and have someone available to instruct his men on proper installation, operation, and maintenance of his machinery. It is logical to assume that a supplier would exert every effort to see that such an operator received the very best of service and that he was not shut down for lack of material."

Adequate inventories near point of use and extension of credit to contractors and producers are traditional functions of any middleman, but the activity of which the supply men are proudest is the additional service they give their customers.

"It may not sound very good to say it this way," one of them remarked, "but at times we practically tell our customers how to run their business.

"By that I mean that we give all kinds of technical and even business

QUESTION: How do you contractors-producers feel about dealing through supply stores?

ANSWER: "Well, most of us think there are tremendous advantages in dealing with our supply companies. First, we don't have to have a lot of our working capital tied up in stock. The supply company saves us this money, which we can put to better advantage. He offers us better service, and even handles our claim service, offers us engineering and technical advice, and is always on the job ready to help us."

advice. We are, in effect, their purchasing agents, so we check over their supplies and equipment and tell them what they are apt to need in the near future. We spot parts that are wearing out or liable to break down and recommend buying replacement parts in advance of trouble.

"We make it our business to keep informed of any future development which may affect prices or supplies of things our customers need, and we advise them when to stock up. For example, we may know that a certain manufacturing plant is scheduled for a shutdown for a major maintenance operation and will be out of production for several weeks, so we take special pains to see that our customers are not caught short as a result.

"Also, we and the other large, integrated supply companies act as maintenance engineers for our customers. Our technically trained representatives check over the machinery of a driller or producer and show him how to make minor adjustments to improve its operation or prolong its life. We make no charge for such routine advice and service, though of course we do make a charge when an operator calls one of our service engineers for a major overhaul or other big job."

PROBABLY the greatest service rendered by the supply store, viewed from the standpoint of the progress of the petroleum industry as a whole, is the work performed in bringing new technology into actual use.

As the link between the manufacturer and the user, the supply-store man is a sort of missionary of progress. Equipment manufacturers spend huge sums in research to develop better tools and machinery and improved methods and practices. All the larger supply companies have on their staffs petroleum engineers, metallurgists,

and other professionally trained experts who attend technical meetings of the oil industry and keep abreast of all new methods in drilling, producing, and other branches of the business.

This information is passed on immediately to all operators, in terms which they can apply to their everyday problems. Most drilling contractors and oil producers are not engineers themselves and many of them have no engineers in their employ, so they depend heavily on the engineers of the supply companies for technical information. This dissemination of technology by means of supply stores is undoubtedly one of the important factors enabling smaller operators to keep up with the research and improvements in the petroleum industry.

"It's all a part of our service," one of these men explained. "We wouldn't be doing our duty if we just peddled hardware. We can't afford to have our customers lose money because of inefficient methods or obsolescent equipment. It's to our advantage to keep our customers prosperous and up-to-date, so we do everything we can to tell them about new techniques they can apply, even though there is no immediate sale of equipment involved."

Right now, because of the national-defense program, supply stores are performing an extra and special service for independent operators and contractors. This is the interpretation and application of the complicated forms and regulations of the Petroleum Administration for Defense and the other government agencies administering the allocation of steel under the Controlled Materials Plan.

"When it comes to dealing with the Government, we have to just about run our customers' businesses for them these days," one supply man explained.

"A lot of operators—and that includes some pretty big ones—just don't seem to take the government regulations seriously. They can't seem to understand that they have to apply for allocations of material long in advance of the time they will need it.

"Our men, of course, have to keep up on these regulations and the proper procedure, so we undertake to help the operators anticipate their needs and fill out the proper forms. But even after we have done all their paper work for them, very often an operator will delay signing and sending in his application until it is too late to get an allocation for the coming quarter.

"Then, like as not, we get blamed because we aren't able to fill the man's order when he wants the material, so that's why we practically have to take over this part of the business of many of our customers."

THE supply store has been a part of the petroleum industry since the very beginning, but its method of operating has changed, along with conditions in the oil business.

"In the old days," one executive observed, "supply stores rushed into every new flush pool. Most of the business was with independents, be-

BAD. The Journal's survey shows drillers-producers want their equipment only when they need it. Instead of stockpiling it for rust and obsolescence, supply stores are supported.

cause in those days most major companies carried their own inventories and did their own warehousing. When the field was drilled up, our business fell off to almost nothing and many stores were closed and moved on to other flush fields.

"Now the business is a good deal more stable. In a new field, of course, the bulk of our over-the-counter sales are to drilling contractors, but spacing rules, conservation practices, and shorter work weeks for crews have all operated to eliminate the old hectic rush to drill, and the development of a field is spread over a much longer period. But our business doesn't stop when the field is drilled up, because producers need much equipment and provide a continuing market. Lots of stores do a good business in areas where there is no new drilling at all, and there are even some which exist primarily to serve water-flood operations."

THE volume of business done through supply stores is proof of the economic function they perform. A composite estimate of a number of supply men is that 30 to 40 per cent of all equipment and supplies used by the petroleum industry is handled over the counters of supply stores. But between 90 and 95 per cent of all the industry's supplies is handled by supply companies even though it does not all go through the stores physically.

This difference between "over the counter" and the 95 per cent is explained by the fact that many of the major companies and other large operators place orders through supply companies but the delivery is made directly from the manufacturer. Some of them order such tonnage items as drill pipe and sucker rods directly from the mills, chiefly as a matter of custom, but the mills turn over to the supply companies (for a small commission) the job of handling the billing and other paper work. Many equipment manufacturers do not sell direct at all, and do all of their distributing through supply companies.

"How about the major companies?" the supply-store men were asked. "Are they good customers, or do they do their own buying and warehousing?"

"Yes, the great majority are," was the usual reply. "Years ago most big operators did all of their own warehousing, and our business was confined almost entirely to the independents. But the trend is away from that.

"Beginning in the 1920's, the supply men realized that a major element of their business was the service they rendered their customers, and that major oil companies could make good use of this service, too. We demonstrated to a good many majors that they could make substantial savings on their equipment costs by letting supply stores carry their inventories and do their warehousing. A number of the major companies made independent studies and reached the same conclusion.

"Today many very large companies carry almost no inventories of equipment, and get all their materials through supply stores. Some, however, prefer to stock their own supplies for various reasons, even though we can show that we can do it cheaper. The time was when a mere district warehouse of a major oil company might have an inventory of $3,000,000. Today that is very unusual, and most big division or area offices do not carry more than perhaps $300,000 in supplies.

"The defense emergency has reversed the trend a little, as some operators want to play safe by building up their own inventories, but except for this the trend is generally toward letting the supply stores do the warehousing and distribution for the oil industry as a whole."

QUESTION: How about your purchase orders? How are they handled?

ANSWER: "Various operators have different procedures. But the old idea of issuing hundreds and hundreds of confirming orders is being supplemented with a blanket order. Emergency orders are charged against the blanket order, without confirmation except signature on delivery ticket. This simplified procedure eliminates a lot of expense both to the suppliers and to us."

"How about centralization?" we asked. "With all the good roads these days, is there a trend toward fewer but larger supply stores?"

"Somewhat so," was the concensus of replies. Certainly there is less moving around to follow flush production, and once a store is located it is more apt to remain in the field.

"Our own company," one of the executives explained, "will not keep a store operating unless it makes money. By the same token, we don't rush to put a store in a new area if we can serve that area efficiently from an established store. Our men travel a lot farther than in the old days, and may cover an area 75 miles or more in diameter. In this way a centralized store can serve a territory which formerly would have three or four stores.

"I would say that the trend is to-

GOOD.—The far-flung supply stores, located in all producing areas, can quickly deliver all needed items, from an electric-light bulb to a complete heavy-duty rotary-drilling rig.

ward fewer but larger stores, though there are still a great number of very small stores serving single fields. And the competition is so keen that every drilling or producing field is certain to be served by at least one supply company, and usually by several."

"What's the average turnover of inventory in a supply store?" was another question put to several interviewed.

"Too low," was the universal answer. Figures of the Petroleum Equipment Suppliers Association show that the average turnover of stock is 1.78 times per year. A number of the larger companies, which have elaborate stock-control systems, turn over their inventories considerably faster than that, on the average, but a turnover as high as three times a year is a goal of perfection which is seldom reached.

"We have to stock a great many slow-moving items," one of the men explained. "When we sell an operator a piece of equipment we feel obligated to carry a complete stock of repair and replacement parts as long as that piece of equipment is in use. We know that we may have to carry many of these items for years without any sales, but that's just part of

the business. Of course a lot of our items turn over rather rapidly, and that helps bring up the average, but the average of our entire line is not much over twice a year in normal times, and that's really too low for good business practice."

"Do you have any trouble getting supplies now?"

"Not too much, considering the defense program. Of course tubular goods and all steel products generally are hard to obtain, but we are on an allocation basis. There is a lot of government paper work involved, but equipment keeps moving from the manufacturers at a fairly even flow."

"What is the biggest dollar item carried by supply stores?"

"Mud pumps are the most expensive single items stocked by most supply stores. Some stores may stock complete drilling rigs which run to $100,000 to $200,000 or more apiece, but most stores carry only certain components and when an entire rig is wanted it is ordered from the manufacturer. When desired, we can assemble and deliver a complete drilling rig, even down to the screwdrivers, and the purchaser doesn't have to worry about the details. Then we help him set it up and see that it is in good running order after the installation.

"Next to mud pumps, the most popular big-dollar items are swivels and rotary tables. The most money is probably tied up in such tonnage items as tubular goods and sucker rods."

EVERY time we talked with one of the supply-store companies we asked the representatives about customer relations in the business.

"We don't have any gripes; we like our customers and like to serve them." That was always the first response. But then some of them modified it a little bit.

"Sometimes," one of them said sadly, "we feel that we 'spoil' our customers by giving them just a little too much service. We give so

much free advice, assistance, and maintenance that some operators come to expect even more from us.

"For instance, we don't make any charge for minor maintenance adjustments made in the course of a routine call, but when a customer sends for one of our maintenance engineers for a major job we have to make a charge and sometimes we suspect that the customer thinks he ought to get that service free, too."

"Here's something our customers could do that would help us a lot and result in better service to them," one man volunteered. "Don't make out small, trivial orders. Wait until you have a substantial order, or accumulate the little odds and ends and combine them in one respectable order. Also, don't ask for free delivery on little items like a wrench or a couple of pipe nipples.

QUESTION: When would you say that oil companies' warehousing practices began to change?

ANSWER: "It was the early twenties when the supply firms finally convinced the companies that warehousing cost nearly 30 per cent of their total equipment costs considering handling and obsolescence. Starting about 1920 the major companies started changing their warehousing practices. In fact, when they went all-out, many a supply company took over the job of complete inventories of these companies."

"Another thing—throw away those little claims against equipment suppliers. We try to adjust all claims in order to keep the customers happy, but the expense involved in handling a trivial claim is usually worth more than the amount involved, both to the customer and to us.

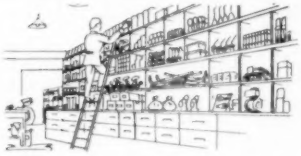
"And don't expect a supply store to stay open 24 hours a day. Store personnel are subject to instant call day or night in case of emergency, but often this service is abused."

This matter of small orders, we found, is something of a pain in the neck to most supply-store operators, though they are reluctant to complain about it.

"We figure it costs us close to $5, on the average, to make every sale," one of them explained. "This cost includes all the paper work, handling, transportation, accounting, and service for an average item from the time we order it from the manufacturer until it is delivered to the customer. Some companies may be able to beat that but we have a rather elaborate accounting and stock-control system. So we can't make much money selling 50-cent items one at a time.

"But don't get the impression that we discourage small sales. We're there to serve customers and that's part of the service. Only sometimes we wish that the drillers and producers would bunch their orders just a little bit more."

THE oil industry was built on competition. Its history indicates that the competition of supply houses to get new methods and equipment into widespread use has been an important factor in the industry's growth.



Without the supply man, it is evident, oil-well drilling and production practices would be quite different today, and considerably more expensive. If every driller and producer had to rustle his own materials, carry large inventories in the field, arrange his own credit, and discover new techniques for himself, the costs and risks of going into business would be much higher than at present.

In fact, if the supply business were not so competitive, and therefore so aggressive and efficient, it is conceivable that small operators could not exist and that today the oil industry would consist of only a few very large companies. Viewed from this angle, it is probably not too much to conclude that the competitive supply business is in large part responsible for the competitive nature of the oil industry.

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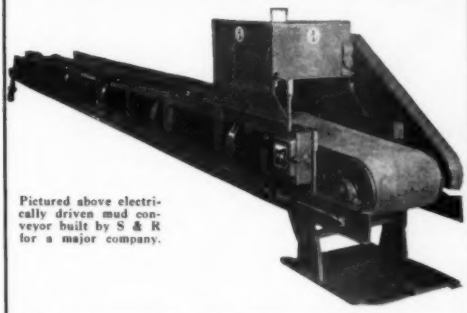

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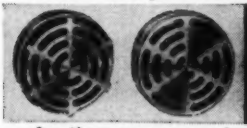

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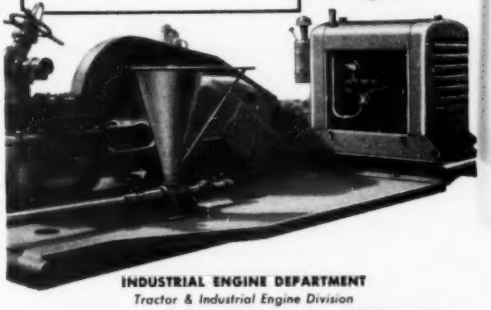

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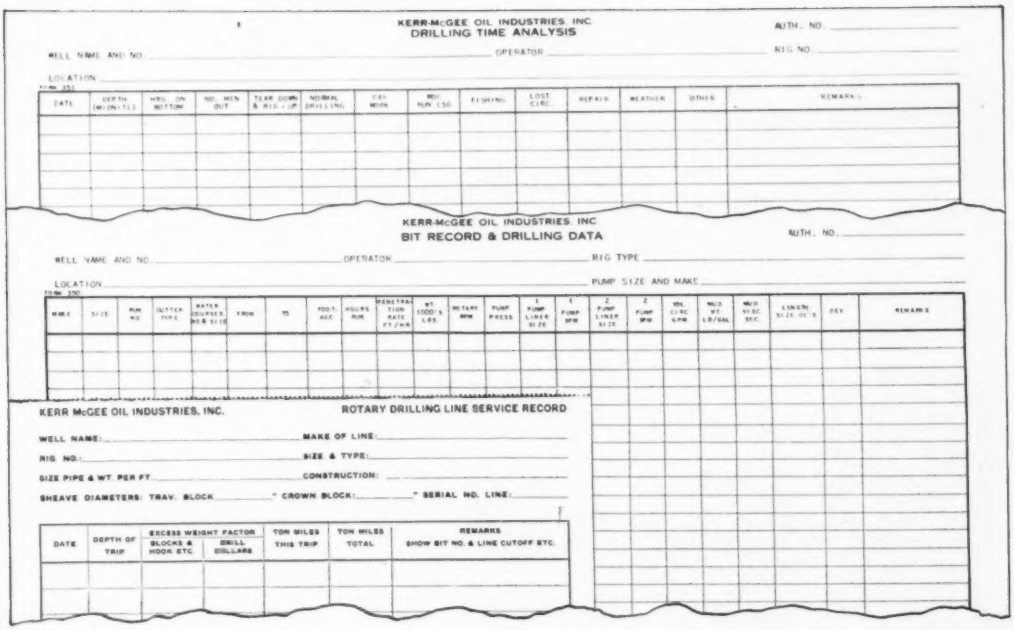


KERR-McGEE OIL INDUSTRIES, INC.
DRILLING TIME ANALYSIS

AUTH. NO.

WELL NAME AND NO. OPERATOR RIG NO.

LOCATION

DATE	DEPTH (MIDNITE)	HRS. ON BOTTOM	NO. MEN OUT	TEAR DOWN & RIG UP	NORMAL DRILLING	DAY WORK	WOC RUN CSG.	FISHING	LOST CIRC.	REPAIR	WEATHER	OTHER	REMARKS

KERR-McGEE OIL INDUSTRIES, INC.
BIT RECORD & DRILLING DATA

AUTH. NO.

WELL NAME AND NO. OPERATOR RIG TYPE

LOCATION PUMP SIZE AND MAKE

MAKE	SIZE	RUN NO.	CUTTER TYPE	WATER COURSES NO. & SIZE	FROM	TO	FOOTAGE	HOURS RUN	PENETRATION RATE FT./HR.	WT. 1000'S LBS.	ROTARY RPM	PUMP PRESS.	1 PUMP LINER SIZE	1 PUMP SPM	2 PUMP LINER SIZE	2 PUMP SPM	VOL. CIRC. GPM	WGT. MUD LB./GAL.	MUD VISC. SEC.	LENGTH SIZE OD'S	DEV.	REMARKS

KERR McGEE OIL INDUSTRIES, INC. ROTARY DRILLING LINE SERVICE RECORD

WELL NAME: MAKE OF LINE:

RIG NO.: SIZE & TYPE:

SIZE PIPE & WT. PER FT. CONSTRUCTION:

SHEAVE DIAMETERS: TRAV. BLOCK " CROWN BLOCK: " SERIAL NO. LINE:

DATE	DEPTH OF TRIP	EXCESS WEIGHT FACTOR BLOCKS & HOOK ETC.	EXCESS WEIGHT FACTOR DRILL COLLARS	TON MILES THIS TRIP	TON MILES TOTAL	REMARKS SHOW BIT NO. & LINE CUTOFF ETC.

Performance Records Guide Contractors

Fact-finding drilling forms afford close check on drilling efficiency, drill-pipe performance, wire-line records, bit performance, and equipment in use.

A NEW streamlined system of engineering well reports affords a constant check on drilling efficiency, drill-pipe performance, wire-line service, and drilling-bit data. A complete control sheet on all surface equipment in use on a given rig is another feature.

Kerr-McGee Oil Industries, Inc., Oklahoma City, operator of some 30 rigs throughout the Mid-Continent, Rocky Mountains, and Gulf Coast fields, has devised this system which is summarized in descriptive and tabular form.

Use and analyses of the Kermac data on operations for the firm's Rig 10 operating in southwestern Nebraska, for example, assisted in doubling the average drilling rate. For the first well in Harrisburg pool, the average penetration rate was 11.7 ft. per hour in the case of 1 Lovercheck, Section 16-18n-55w, during October-November, 1950. For the same rig, speed increased well by well and the rate went to as high as 22.2 ft. per hour for the fifth consecutive well, this being 2 W. W. Downer, Section 6-18n-55w.

Auxiliary Data Sheets

To gather the data consolidated on the "ENGINEERING WELL REPORT," a series of three auxiliary field data sheets are prepared in the field including (1) "DRILLING TIME ANALYSIS," (2) "BIT RECORD AND DRILLING DATE," and (3) "ROTARY DRILLING LINE SERVICE RECORD."

1. Drilling-time analysis. — Work sheet for drilling-time breakdown appears in a table (see illustration) which carries the following headings arranged in 14 columns as follows: date, depth (midnight), hours on bottom, number of men out, tear-down and rig-up time, normal drilling time, day work, WOC and run casing time, fishing time, lost-circulation time, repairs, time losses due to weather, miscellaneous, and remarks.

This form permits ready calculation of the total number of hours involved in each type of operation; and these end figures, obtained by running column tapes, are then transferred to the respective column shown on the "TIME ANALYSIS RECORD" in the "ENGINEERING WELL REPORT" proper.

2. Bit record and drilling data.—At first glance, the Kermac sheet for these items appears cumbersome. However, on detailed analysis this form is one of the easier to handle (see illustration). Headings include make of bit, bit size, run number, and cutter type. Footage is carried with depth range and hours carried with penetration rate in feet per hour. Weight on bit, rotary speed and average pump pressure, pump-liner size, pump speeds, and mud volume circulated are carried successively in adjacent columns to the right. Mud weight and mud viscosity are carried in adjoining columns. Length and size of drill collars are carried successively to the right, followed by the deviation record. The "REMARKS" column is highly important in that significant details such as coring, reaming, and circulating to run casing are carried.

3. Rotary drilling-line service record.—This auxiliary form (see illustration) is easy to fill out and maintain on a daily basis. Arranged at the top of the form in two rows are the basic data such as well name, make and serial number of line, rig number, size and type of rig, pipe size and weight per foot, type construction, and sheave diameters of

both the traveling and crown blocks.

The form proper contains only seven columns arranged as follows: date, depth of trip, excess weight factors, blocks and hooks, etc. and drill-collar weight) ton-miles this trip, and cumulative ton-miles. A column for "REMARKS" carries information such as line cutoff and bit size.

Engineering Well Report

Facts gathered on these auxiliary data forms are transferred to a master set of "ENGINEERING WELL REPORT" comprised of a set of five sheets, arranged as follows:

1. **MAJOR EQUIPMENT RECORD.**
2. **TIME ANALYSIS.**
3. **DRILLING-STRING PEFORMANCE.**
4. **DRILLING-LINE RECORD.**
5. **DRILLING PROCESSES.**

Four copies of the complete set of forms for the control system are prepared for distribution as follows:

ORIGINAL—to Oklahoma City office master well file.

COPY—to Division Drilling Office.

TWO COPIES—to District Drilling Office.

In practice, the forms are printed by lithograph process on 8½ by 14-in. white paper and made up in pads of 10 five-sheet sets.

Geological-formation tops.—The lithologic characteristics of the various formations encountered obviously affect penetration rates. For this reason, the tops of each geological formation are carried in a box within the "Drilling Processes" sheet. Another way of handling this feature is to transfer the pertinent tops from this sheet to depth-time curve. *(See The Oil and Gas Journal, September 28, 1950, page 102.)*

General comments.—A key to pertinent details relating to drilling performance is often contained in this series of lines in the record provided for miscellaneous comment. Space is provided here for information that does not lend itself to formal engineering treatment, such as the availability of rig labor, unusual drilling problems, recementing problems, and the like.

Cover sheet.—The first sheet is a summary presenting information as shown in Table 1.

TABLE 1—COVER SHEET FOR ENGINEERING WELL REPORT (KERR-McGEE)

DIVISION .....

DISTRICT .....

TOOLPUSHER .....

WELL NAME .....

AUTHORIZATION NUMBER .....

LOCATION .....

POOL NAME .....

COUNTY .....

STATE .....

OPERATOR .....

RIG NO. ..... MAJOR EQUIPMENT RECORD

CASING PROGRAM: TOTAL DEPTH ..... FT.

..... HORIZON

MAJOR EQUIPMENT RECORD (Form attached)
TIME ANALYSIS (Form attached)
DRILL STRING PERFORMANCE (Form attached)
DRILL COLLAR PERFORMANCE (Form attached)
DRILLING LINE RECORD (Form attached)
DRILLING PROCESSES (Form attached)

Major Equipment Record

The form for this subject lists the make, model, and serial number of the following items: **hoist, hoist engines, independent pump engines, slush pumps, rotary table,** and **swivel.** The rig arrangement is shown by a sketch attached to the form.

Casing program is set out by size, weight, and grade of each string; also listed is the number of sacks of cement required.

Time Analysis Record

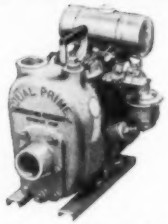
This study comprises one of the outstanding features of the engineering well report. An entire sheet is devoted to time analyses.

Elapsed days is shown in two ways: (1) from rig up to tear down and (2) from spudding date to total depth.

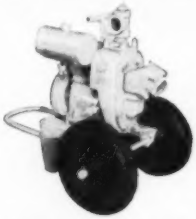
Special attention is given to the breakdown of **LOST TIME** with major

DUAL PRIME AND STRAIGHT CENTRIFUGAL PUMPS

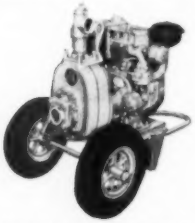
Include CLOSE-COUPLED CONSTRUCTION
SELF-ADJUSTING ROTARY SHAFT SEALS
HYDRAULICALLY BALANCED IMPELLERS



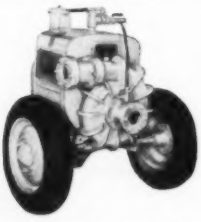
MODEL 21 2" PUMP 1 H.P.
DUAL PRIME
25 GPM @ 27 PSI 60 GPM @ 17 PSI



MODEL 24 2" PUMP 4 H.P.
DUAL PRIME
50 GPM @ 39 PSI 125 GPM @ 30 PSI



MODEL 2H7 2" PUMP 7 H.P.
DUAL PRIME HI-HEAD
30 GPM @ 100 PSI 60 GPM @ 69 PSI



MODEL SS3H2S 3" PUMP 25 H.P.
PRESSURE-FLO
200 GPM @ 122 PSI 400 GPM @ 70 PSI

FOR INFORMATION ON OTHER MODELS OF THE EXTENSIVE CMC LINE OF PUMPS, CONTACT YOUR NEAREST CMC SUPPLY STORE OR . . .

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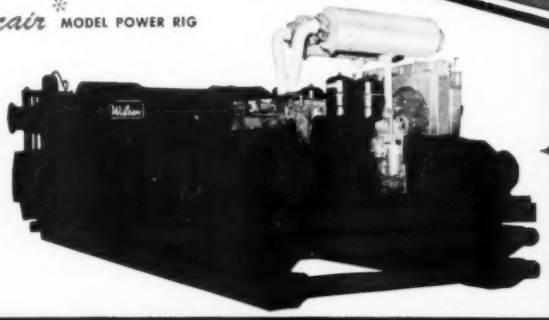
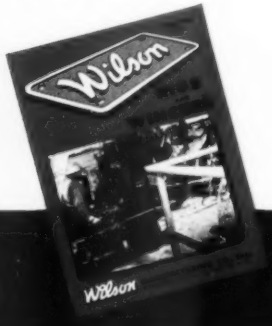
Giant Single Engine Torcair* MODEL POWER RIG

RATED CAPACITY — 5,000 Ft., Using 4½" Drill Pipe
or 6,000 Ft., Using 3½" Drill Pipe



5,000' to 6,000'

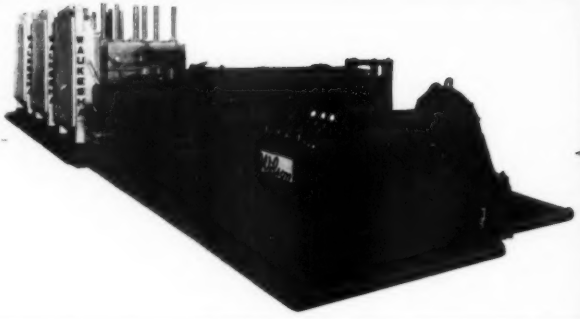


Write FOR CATALOG NO. 182 FOR COMPLETE SPECIFICATIONS and DETAILS

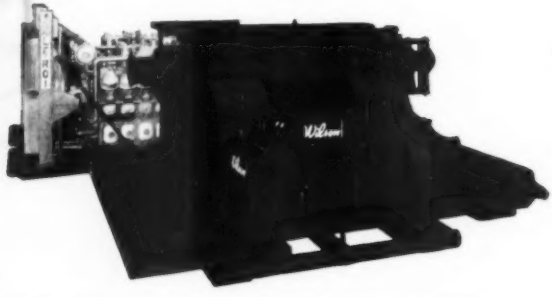
Giant Torcair*-Roadair

MODEL POWER RIG

RATED CAPACITY —
8,000 Ft., Using 4½" Drill Pipe
9,500 Ft., Using 3½" Drill Pipe



8,000' to 9,500'



Titan Torcair*-Roadair

MODEL POWER RIG

RATED CAPACITY —
12,500 Ft., Using 4½" Drill Pipe
15,000 Ft., Using 3½" Drill Pipe

12,500' to 15,000'

Super Titan "66"

TORCAIR-ROADAIR
MODEL POWER RIG

RATED CAPACITY —
22,000 Ft., Using 4½" Drill Pipe
25,000 Ft., Using 3½" Drill Pipe

22,000' to 25,000'

* *Trade Mark Registered*

divisions listed as Fishing, Lost Circulation, Weather, and Repairs. The last item is subdivided into repairs to engines, pumps, draw works and compound, swivel, rotary table, and other equipment.

Time on bottom.—This item is utilized in several ways on the "Time Analysis Record."

Determination of the number of hours on bottom is obtained from an auxiliary work sheet entitled: "DRILLING TIME ANALYSIS" illustrated and discussed earlier in this article. This entry is made on the bottom of the table below. On division by 24 hours, the number of days is entered on the form.

Rig efficiency may be calculated by dividing the number of days on bottom by the normal drilling days obtained from previous case histories in the area. Rate of penetration, obtained simply by dividing the total number of feet drilled by the number of hours on bottom as obtained above, comprises one of the most important end figures required by the contractor in consideration of future contracts.

Penetration Curve

Drilling-department officials can tell at a glance from examination of the penetration curve whether or not the subject well performance will earn the firm a profit or loss. This is done by plotting in advance in a dashed red line, a representative or "pattern" well. Current drilling progress is plotted in a solid line and correlation between the two lines indicates the performance vs. type well correlation.

This graph also contains (1) deviation record, (2) footage per bit and a series of drilling curves. The latter

FORM FOR "MAJOR EQUIPMENT RECORD"

RIG NUMBER .....

HOIST:
Make & Model .....
Serial No. ..... Company No. .....
Pump Drive Sheave:
No. 2 Engine, Pulley Dia. ..... in.
No. and size grooves .....
No. 3 Engine, Pulley Dia. ..... in.
No. and size grooves .....

HOIST ENGINES:
No. 1: Make & Model .....
No. 2: Make & Model .....
No. 3: Make & Model .....

INDEP. PUMP ENGINES:
No. 1: Make & Model .....
No. 2: Make & Model .....

SLUSH PUMPS:
No. 1: Make & Model .....
Sheave Pulley Dia. ..... in.
No. and size grooves .....
No. 2 Make & Model .....
Sheave Pulley Dia. ..... in.
No. and size grooves .....
No. 3: Make & Model .....
Sheave Pulley Dia. ..... in.
No. and size grooves .....

ROTARY TABLE:
Make & Model .....
Size ..... Serial No. .....

SWIVEL:
Make & Model .....
Size ..... Serial No. .....

RIG ARRANGEMENT:
(Sketch attached — Brief discussion if necessary)

CASING PROGRAM:	String No. 1	2	3
TOTAL DEPTH	—	—	—
LENGTH	—	—	—
SIZE	—	—	—
WEIGHT	—	—	—
GRADE	—	—	—
SACKS CEMENT	—	—	—

BITS:*	Sequence 1	2	Etc.
MFGRS. NUMBER	—	—	—
SIZE	—	—	—
TYPE	—	—	—

FROM ..... TO .....

*Detailed Bit Record attached.

"first" with the oil industry
HONAN-CRANE OIL PURIFIERS

Among the major oil producing and pipe line companies using Honan-Crane oil purification equipment are:

Tennessee Gas Transmission Company
Cities Service Refining Corporation
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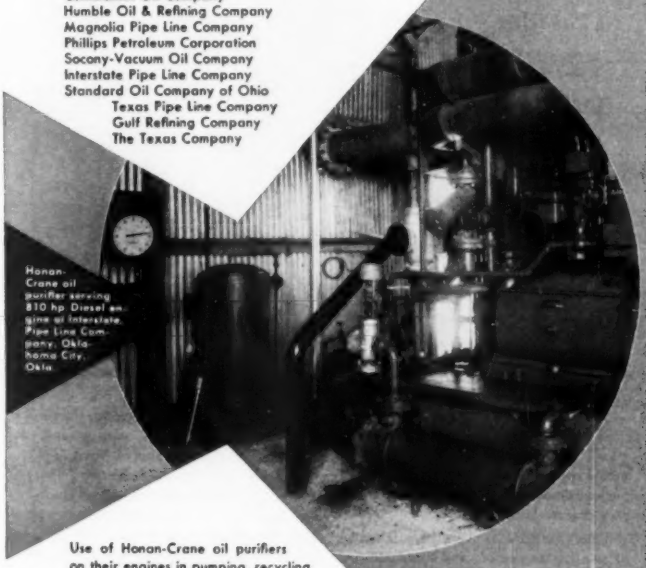
Phillips Petroleum Corporation
Socony-Vacuum Oil Company
Interstate Pipe Line Company
Standard Oil Company of Ohio
Texas Pipe Line Company
Gulf Refining Company
The Texas Company



Honan-Crane oil purifier serving 810 hp Diesel engine at Interstate Pipe Line Company, Oklahoma City, Okla.

Use of Honan-Crane oil purifiers on their engines in pumping, recycling and other oil operations pays off—has given them, economical, trouble-free engine performance—with greatly reduced maintenance costs.

Honan-Crane purifiers give you your choice of purifying media—to suit the type of oil you use—either Cranite (specially processed fuller's earth) or Palconia (selected cellulose fiber filtering medium).

Write today for complete information on purifiers for Diesel, gas engines, compressors, lubricating oils, etc.

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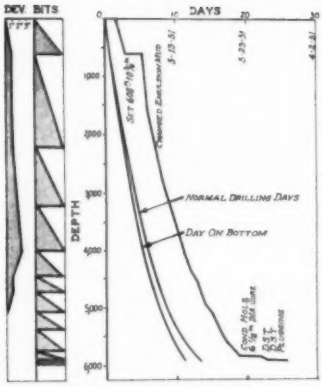


Penetration chart (Kerr-McGee).

item is in turn subdivided into the following:

TOTAL DAYS ON BOTTOM: pattern or representative well.

TOTAL ROTATING TIME: pattern or representative well.

TOTAL RIG TIME: performance of current project well from rig up to tear down, including WOC time, diamond-coring time, drill-stem-test time, mud-conditioning time, and the like.

FORM FOR "TIME ANALYSIS"

(Record attached; also Time on Bottom and Normal Drilling Curves)

Start Rig Up (Date) .....
Finish Tear Down (Date) .....
Elapsed Days, No. ..... _____

Spud (Date) .....
Reached Total Depth (Date) .....
Elapsed Days ..... _____
Motor Days (per Oklahoma City Office) ..... _____
Rig Up (Crew-Days: Total Man-Hours ÷ Man Hours in Normal Crew-Day) ..... _____

Tear Down (Crew-Days) ..... _____

Normal Drilling (Total Time) ..... _____

Daywork (Total Time) ..... _____
Run Casing and Waiting on Cement:
String 1 (Days) ..... _____
String 2 (Days) ..... _____
String 3 (Days) ..... _____
String 4 (Days) ..... _____
Casing and WOC TOTAL: _____

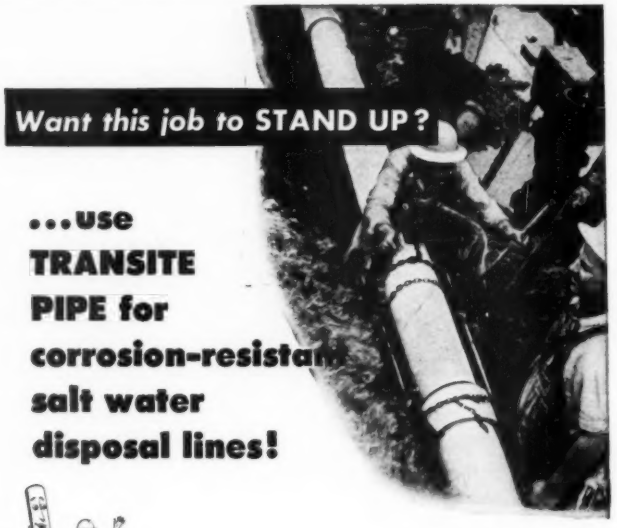
LOST TIME:
Fishing (Total Time) ..... _____
Lost Circulation (Total Time) ..... _____
Weather (Total Time) ..... _____
Repairs: (Unusual excessive delay, i.e., over 4 hours per day):
Engines ..... _____
Pumps ..... _____
Drawworks and compound ..... _____
Swivel ..... _____
Rotary Table ..... _____
Other Equipment ..... _____
..... _____
Other Lost Time ..... _____
Total Lost Time: _____

Total Well Time in Days: _____

Hours on Bottom: (Total* Hours ÷ 24 = ... Days: _____
Rig Efficiency (Days on Bottom ÷ Normal Drilling Days) ..... (Per Cent) _____
Rate of Penetration (Feet Drilled ÷ Hours on Bottom) ..... (Ft./Hr.) _____

REMARKS:

*Figure from Auxiliary Work Sheet.



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NO NEED to run up overhead through costly replacement of your salt water disposal lines. Just lay Transite* Pressure Pipe . . . the pipe that stands up under corrosive attacks where ordinary pipe materials fail.

That's because Transite Pipe is made of an asbestos, cement and silica composition, by a special Johns-Manville process that imparts high corrosion resistance all the way through. Transite resists the destructive action of salt water on the inside—as well as corrosive soil on the outside. Moreover, this strong, durable pipe withstands all normal service temperatures—will not deform in use.

In addition to its long life, Transite Pipe offers these other money-saving advantages: (1) economical handling—most sizes can be unloaded and lowered into the trench without mechanical handling equipment; (2) rapid assembly, because of Transite's factory-made Simplex Couplings; (3) complete adaptability to oil field requirements—assured by a full range of pipe sizes, plus fittings for every need.

For further information write Johns-Manville, Box 290, New York 16, N. Y.

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Johns-Manville
TRANSITE PRESSURE PIPE

Drilling-line record form sheet specifies date of installation, ton-miles for

FORM FOR "DRILLING LINE RECORD"

	Line No. 1	2	3
DATE INSTALLED	—	—	—
MAKE	—	—	—
SIZE (DIAM. × LENGTH)	—	—	—
HEMP OR IWRC	—	—	—
TON MILE* THIS WELL	—	—	—
PREVIOUS TON MILE	—	—	—
TOTAL TON MILE*	—	—	—
TON MILE PER FT. OF LINE	—	—	—

*Data from auxiliary work sheet.

from every field, the reports pile in:

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When we introduced the new A-2 Bullet Perforator, we knew what it would do. We'd proved it. But now, only a few months later, operators in nearly every field have proved it for themselves. "Much greater penetration" say the reports from one oil area after another. And many reports claim that the figures we first quoted are more than conservative. However, since these exceptional jobs may represent unusual or purely local conditions, we'll simply repeat our first proved-by-test figures on the A-2 Bullet Perforator . . .

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subject well, previous ton mileage, total ton-miles, and ton-mile per foot of line.

Drill String and Drill Collar Records

Drill-pipe data sheet has eight columns for number of joints, size and grade, previous footage drilled, footage for subject well, total footage, and wear factor.

FORM FOR "DRILL STRING PERFORMANCE"

DRILL PIPE:	Group 1	2	3
No. Joints	—	—	—
Size	—	—	—
Grade	—	—	—
TOOL JOINTS: Make	—	—	—
Type	—	—	—
Calipered o.d.	—	—	—
TUBE-SCOPE GRADE	—	—	—
PREVIOUS FOOTAGE DRILLED	—	—	—
FOOTAGE THIS WELL	—	—	—
TOTAL FOOTAGE	—	—	—
WEAR FACTOR	—	—	—

Drill-collar record carries five columns including number of collars, length, calipered o.d. type, and manufacturer's number.

FORM FOR "DRILL COLLAR PERFORMANCE"

	Group 1	2	3
SERIAL NO.	—	—	—
MAKE	—	—	—
LENGTH	—	—	—
CALIPERED O.D.	—	—	—
JOINT TYPE	—	—	—
PREVIOUS FOOTAGE DRILLED	—	—	—
FOOTAGE THIS WELL	—	—	—
TOTAL FOOTAGE	—	—	—
WEAR FACTOR	—	—	—

Drilling Processes

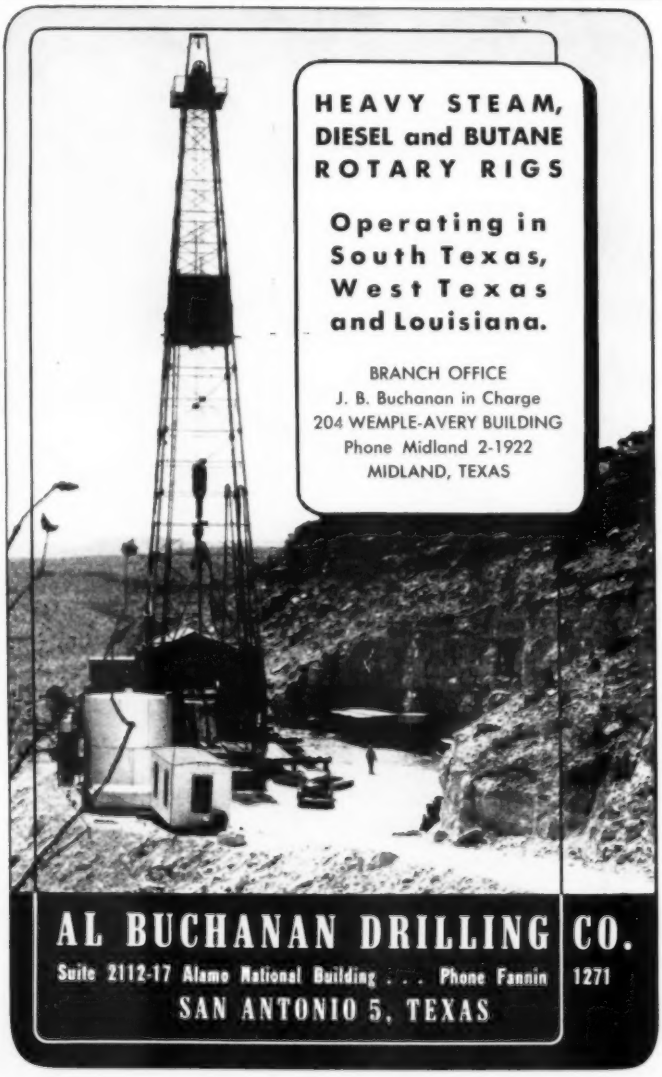
This comprehensive tabulation contains items of major interest to drilling engineers. Included are average rate of penetration, weight on bit, weight of drill collars, pump pressure, mud volume circulated, annular velocity, rotary speed, mud weight, and mud viscosity. Typical performance recorded for these factors for three different size bore holes appears in this form, as illustrated below:

FORM FOR "DRILLING PROCESSES"

(Kerr-McGee Oil Industries, Inc., and Standolind Oil & Gas Co. 1 Lovercheck, NE NE NW 4, Sec. 16-18n-55w, Harrisburg Pool, Banner County, Nebraska)

	Hole size (9-in.)*
1. RATE OF PENETRATION, ft./hr.	11.17
2. WEIGHT ON BIT, lb.	11,400
3. WEIGHT ON BIT PER INCH OF DIAM.	1,267
4. WEIGHT OF DRILL COLLARS	11,706
5. RATIO OF WEIGHT ON BIT TO DRILL COLLAR WEIGHT	0.97
6. PUMP PRESSURE, psig.	518
7. MUD VOLUME CIRCULATED, g.p.m.	322
8. ANNULAR VELOCITY, ft./min.	130
9. ROTARY SPEED, r.p.m.	85.5
10. MAXIMUM DEVIATION AND DEPTH	
11. MUD WEIGHT, lb./gal.	
12. VISCOSITY, Sec. A.P.I.	

*Other columns similarly were filled out for the 13¾-in. hole, and the 7½-in. core hole.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BOOKS

FACTUAL DATA 56. ENGINEER'S REPORT OF OIL AND GAS RESERVOIRS UNDER STATE CONTROL, 1950. Published by the State of Arkansas Oil and Gas Commission, Trimble Building, El Dorado, Ark. 68 pp.

This booklet describes production of oil, gas, and condensate in the State of Arkansas for the year 1950, and explains the drilling program carried on in the state during that period. Numerous tables are given which show production by fields and the various productive formations. The booklet is well illustrated with various diagrams showing production of the various fields.

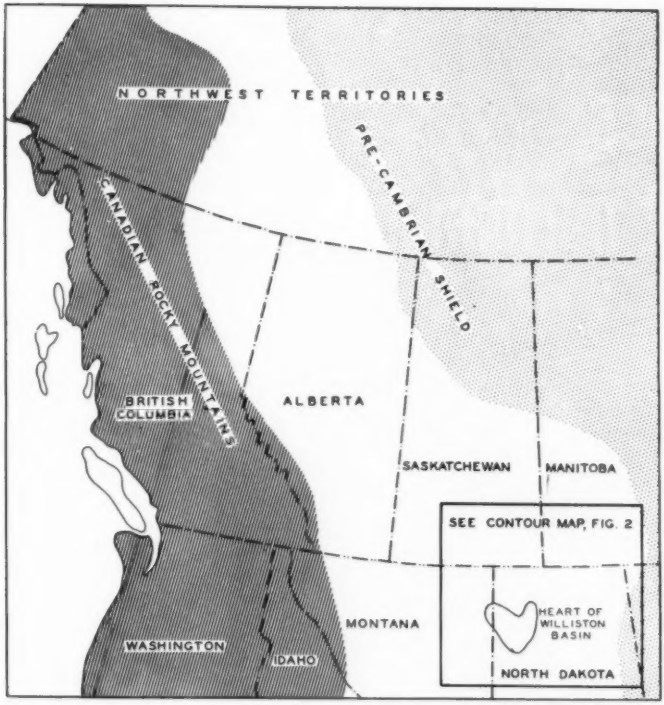

Fig. 1—Great sedimentary plain of northwestern United States and western Canada.

Manitoba's Role in Williston Basin's Drilling Program

It was a wildcat in the southwestern part of this province that launched the current high interest and activity throughout the basin

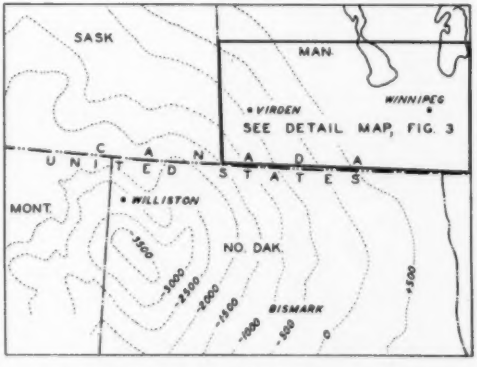

Fig. 2—Structure map of the Williston basin contoured on top of Cretaceous-Dakota group.

by Polly DeArmond

FOR some time now the attention of the industry has been focused on the Williston basin, a 100,000-sq. mile unit that covers southwestern Manitoba, southeastern Saskatchewan, northeast Montana, and both Dakotas. Recent strikes in the United States division of the basin have emphasized the most exciting exploratory campaign of the year.

But it all started fairly quietly 6 months ago—preceding the recent "hot" discovery news (Amerada Petroleum Corp.'s North Dakota find, and Shell Oil Co.'s successful test in Montana) by 3 months or more, when a wildcat in southwestern Manitoba recovered the first significant quantity of oil in that Canadian province, and launched the intensive Williston basin play. A resume of activity in the relatively unheard-of northeasternmost corner of that structural feature is presented here.

The story of oil in western Canada has consisted almost entirely of activity in Alberta, which unquestionably has been and will continue to be tremendous. Saskatchewan, before an increase in exploration this year, shared any mention of Alberta by virtue of production in the Lloydminster area, although last year a small discovery of heavy-gravity crude was brought in near Hearts Hill approximately 65 miles south of Lloydminster and 13 miles east of the Alberta border.

Manitoba has barely been mentioned except for sporadic wildcatting, and four refineries in Brandon, Winnipeg (East St. Paul), St. Boniface, and East Kildonan, with capacities for processing 25,600 bbl. per day by a combination of methods.

History of Drilling—Development

There has been, however, steady interest in oil possibilities in Manitoba, particularly that portion which lies within the "Williston" confines. Indeed, it has been claimed that exploration for oil or gas in western Canada started in Manitoba, with the first test wells drilled near Dauphin (No. 25 on detail map) in 1887 before any work in the other western provinces. Since then, much geological and geophysical study has been conducted in the province, although actual drilling has been limited to a few widely dispersed ventures. Up to the present day, there have been about 60 holes completed; limited volumes of natural gas have been found in some; others recovered shales with oil shows.

In 1947, oil and gas-rights regulations were revised, leasing picked up, and the first extensive seismic and

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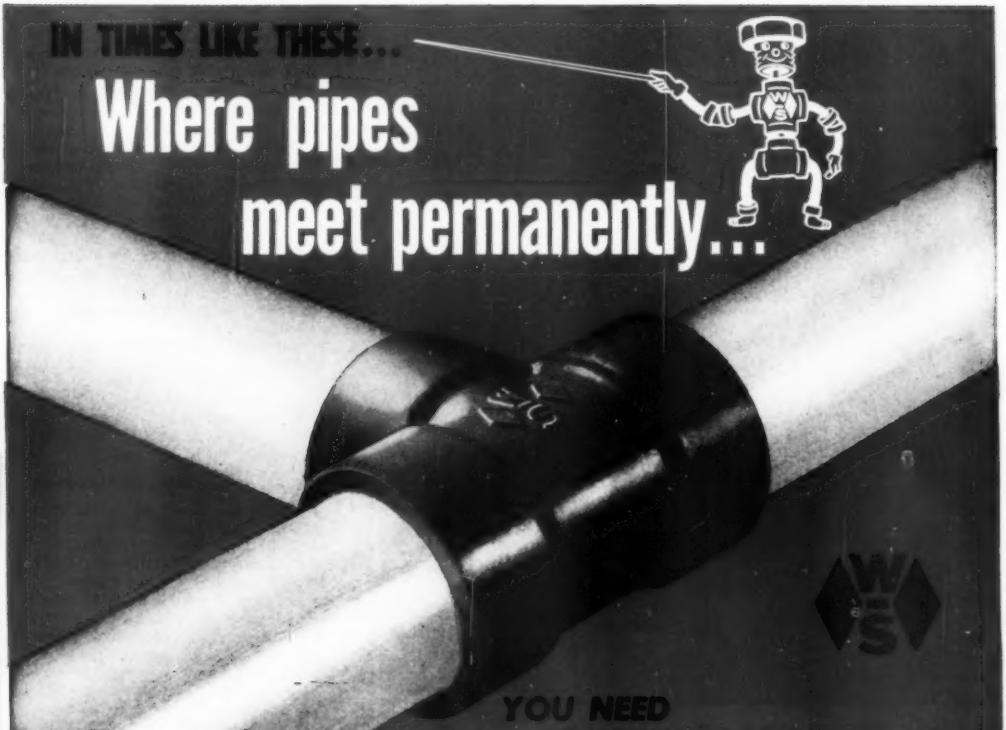

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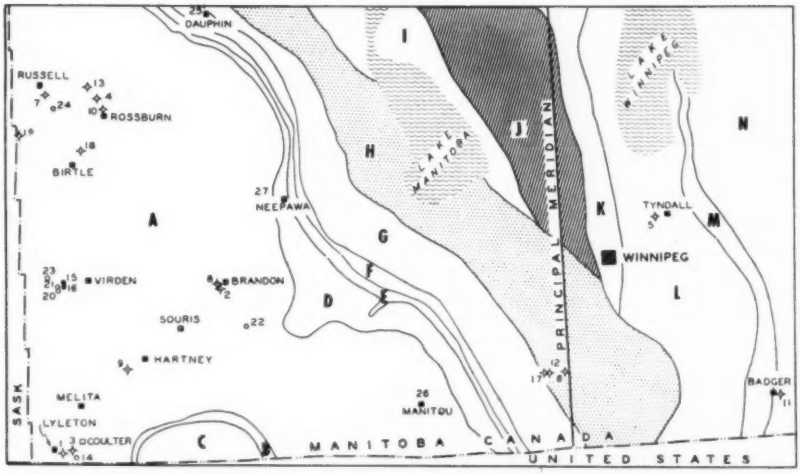


Fig. 3—Detailed map of wells and geologic legend of southwestern Manitoba.

LEGEND

A. Upper Cretaceous (Riding Mtn. fm.), gray siliceous shales.
B. Cretaceous or Tertiary (Boissevain fm.), clay, sand, and coal.
C. Tertiary (Turtle Mtn. fm.), clay, sand, and coal.
D. Upper Cretaceous (Vermilion River fm.), gray and speckled calcareous shales.
E. Upper Cretaceous (Favel fm.), speckled calcareous shale, lime, and bentonite.
F. Lower (?) and Upper Cretaceous (Ashville fm.), dark gray shale, silt and sand, and lime.
G. Lower Cretaceous (Swan River fm.), sand, variegated shales, and clay.
H. Jurassic (Amaranth fm.), dolomitic lime, red shale, and anhydrite.
I. Middle Devonian (Elm Point fm.), lime and dolomite.
J. Silurian (Stonewall fm.), dolomite.
K. Upper Ordovician (Stony Mtn. fm.), lime, dolomite, and red shale.
L. Upper Ordovician (Red River fm.), lime and dolomite.
M. Upper Ordovician (Winnipeg fm.), sand and shale.
N. Acidic intrusive rocks, granite.

MANITOBA DRILLING FROM 1949 TO JULY 1951

Map No.	Well name and location—	Comp. date*	Result	Total depth (ft.)	Elev. (ft.)
1.	Souris Valley 1 White, LSD 5, 14-1-26w P.M.	June 1949	Dry	5,160	1,493 D.F.
2.	Manitoba Syn. 1 Coutts, LSD 9, 10-10-19w P.M.	Aug. 1949	Dry	840	1,262 Gr.
3.	Souris Valley 1 Moore, LSD 5, 20-1-27w P.M.	Oct. 1949	Dry	6,030	1,490 D.F.
4.	Cleland 3, LSD 4, 22-20-25w P.M.	Oct. 1949	Dry	1,956	1,786 Gr.
5.	Red River 1, LSD 13, 6-13-6e P.M.	July 1950	Dry	622	780 Gr.
6.	Red River 2, LSD 2, 1-5-1w P.M.	July 1950	Dry	953	795 Gr.
7.	Red-Man 1 Smith, LSD 13, 35-20-28w P.M.	Sept. 1950	Dry	1,029	1,865 Gr.
8.	Manitoba Syn. 2 Coutts, LSD 14, 16-10-19w P.M.	Oct. 1950	Dry	3,565	1,319 K.B.
9.	Cal. Std. 16-33 Hartney, LSD 16, 33-5-24w P.M.	Oct. 1950	Dry	5,138	1,411 Gr.
10.	Red-Man 3, LSD 16, 36-19-25w P.M.	Oct. 1950	Dry	1,020	
11.	Whiteside 1, LSD 13, 5-3-12e P.M.	Oct. 1950	Dry	682	1,244 Gr.
12.	Red River 1 Hepner, LSD 3, 1-5-2w P.M.	Nov. 1950	Dry	630	
13.	Red-Man 4, LSD 14, 6-21-25w P.M.	Nov. 1950	Dry	1,061	
14.	Souris Valley 1 Downey, LSD 11, 9-1-27w P.M.	Standing		3,200 PB	1,493 Gr.
15.	Cal. Std. 15-18 Daly, LSD 15, 18-10-27w P.M.	Jan. 1951	Oil (SI)	5,368	1,602 Gr.
16.	Cal. Std. 10-18 Daly, LSD 10, 18-10-27w P.M.	Testing	Oil	2,334	
17.	Red River 2 Hepner, LSD 3, 1-5-2w P.M.	Feb. 1951	Dry	1,045	
18.	Imperial 1 Birtle, LSD 1, 27-17-26w P.M.	May 1951	Dry	4,250	
19.	Imperial 1 Medicine, LSD 16, 18-18-29w P.M.	July 1951	Dry	4,456	
20.	Cal. Std. 2-12 Daly, LSD 2, 12-10-28w P.M.	Drilling		2,250	
21.	Cal. Std. 7-12 Daly, LSD 7, 12-10-28w P.M.	Testing	Oil	2,528	
22.	Cal. Std. 3-1 Wawanesa, LSD 3, 1-8-18w P.M.	Rigging up			
23.	Cal. Std. 8-29 West Daly, LSD 8, 29-10-28w P.M.	Location			
24.	Imperial 1 Foxwarren, LSD 16, 32-19-27w P.M.	Location			

*On most wells, detailed information is held confidential by the Provincial Government until 1 year after completion.

surface geological work began. Reflection seismograph became the popular exploration tool, and the gravity meter came into use. Now, oil has been found in Manitoba, although commercial potentialities of the discovery have not been completely evaluated. Follow-up wells are testing the area, other exploration is being planned, and four seismograph parties are busy throughout the western half of the province.

Geology

The subject portion of Manitoba is the eastern boundary of the large depositional basin stretching east-west between the Canadian Shield and the Rockies. The sediments of this eastern fringe are comparatively thin, dipping to the southwest, Two Commonwealth Petroleum, Ltd., shallow tests near Manitou (No. 26 on

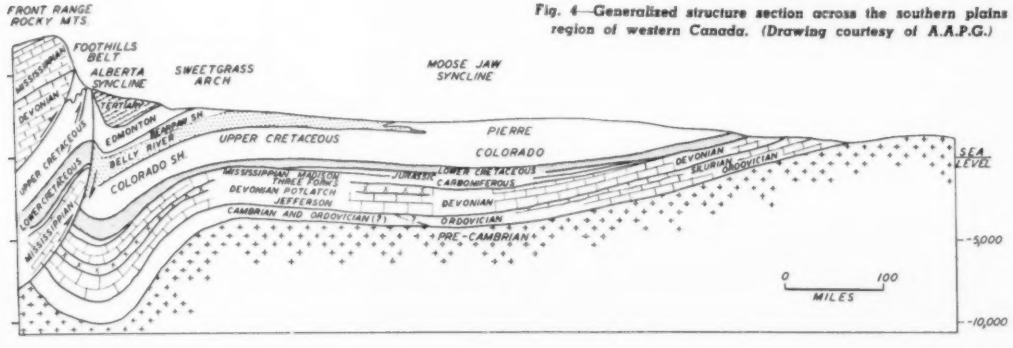


Fig. 4—Generalized structure section across the southern plains region of western Canada. (Drawing courtesy of A.A.P.G.)

detail map), and a Langford venture near Neepawa (No. 27 on detail map) reached pre-Cambrian basement around 2,500-2,620 ft. levels without encountering the Madison.

Correlation with wells drilled farther south and west showed a rapid pinchout of the Madison to the northeast. Thus far, drills have proved considerable accumulations of Cretaceous, Devonian, and Ordovician deposits, and the possibilities of sedimentary wedges of Mississippian and Triassic ages continuing into Manitoba from southeastern Saskatchewan and North Dakota.

Structural divisions. — Within the large western Canada sedimentary plain are four major structural units: the Alberta syncline, the Sweetgrass arch, the Moose Jaw syncline, and the Alberta homocline. (See Fig. 4.)

The Alberta syncline, an asymmetric trough, lies just east of the foothills in southern Alberta but diverges to the east as it is followed northward. The Sweetgrass arch crosses into the southeastern corner of Alberta from Montana and angles northeastward until it loses its identity near the Alberta border.

The Moose Jaw syncline, a northern extension from the heart of the Williston basin in North Dakota, cuts northwest-southeast across the southwestern corner of Saskatchewan and, like the Sweetgrass arch, loses its identity near the Alberta border where the two features blend into the Alberta homocline.

The northeast flank of the Moose Jaw syncline may be thought of as a southern continuation of the Alberta homocline. Current activity in Manitoba is in the area of this shallow homoclinal belt.

A generalized "stratigraphic column" of Paleozoic-age formations in the area embraces: **ORDOVICIAN**— Winnipeg sandstones underlying Red River limestones, which in turn are overlain by Stony Mountain shales and limestones; **SILURIAN** — exposures of nonporous dolomitic limestones and gypsum; **DEVONIAN**— Elm Point limestone beneath Winnipegosan dolomite with reef beds underlying Manitoban limestone which is covered by Lyleton shales and dolomites; **MISSISSIPPIAN** — Madison series overlain by Charles limestones, anhydrites, and shales.

Drilling Operations

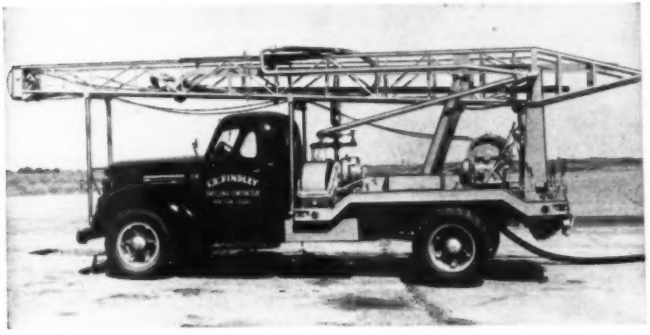
1949.—The first proof that limestone of Devonian age (the principal producing zone in the prolific Alberta fields) was present in Manitoba was furnished by Souris Valley Oil Co., Ltd., 1 White, which found over 400 ft. of Devonian. This well, $2\frac{1}{2}$ miles from the international boundary, also found a very thick section of the Madison. This limestone was yellow (turning to gray at greater depths), porous, and believed to be reef structure because of the Mississippian fossil corals recovered in cores at 3,375-92 ft. An electric log run to 5,029 ft. indicated other porous intervals at 3,370-3,430 ft., 3,520-90 ft., 4,700-35 ft., and 4,854-84 ft.

The following tops were logged: Favel 1,710 ft., Ashville 1,900 ft., Swan River 2,150 ft., Jurassic 2,240 ft., Amaranth 2,890 ft., Spearfish 3,180 ft., Madison 3,350 ft., Lyleton 4,260 ft., Upper Devonian 4,350 ft.

The well had vuggy porosity but recovered salt water on top of the Devonian. The hole, cased to bottom, was gun perforated at 4,330-39 ft., swabbed oil, but salt water broke in. Encroachment of salt water occurred again at perforations at 3,495 ft. After swabbing perforations at 3,342-48 ft. and 3,360-66 ft., it reportedly started flowing water with traces of oil and gas. Oil shows were rumored in the Lower Cretaceous at 2,161 ft. There were traces of light-gravity crude on a drill-stem test at 4,399-4,412 ft. At 4,854-84 ft. and 5,020-40 ft., oil was reported on pit. The well had a faint blow of gas during a formation test at 3,914-91 ft., and a small gas show in samples taken at 3,710-30 ft.

The second completion for the year was Manitoba Gas & Oil Syndicate 1 Coutts, drilled as a search for natural gas. This test had a gas show at 840 ft. The following tops were picked: Favel 560 ft., Ashville 720 ft., Swan River 830 ft.

Later, Souris Valley finished the deepest hole ever drilled in Manitoba, the 1 Moore, located about 160 ft.



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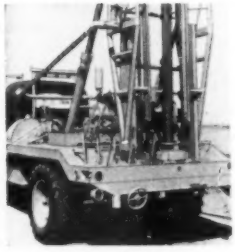

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upstructure from the operator's 1 White. The Moore, like the first venture, was cased to bottom, and had vuggy porosity but got salt water on top of the lime.

Moore details.—It, too, had indications of possible gas porosity at several intervals: 3,410-3,500 ft., 3,790-3,820 ft., 4,210-60 ft., 4,430-50 ft., 4,480-4,500 ft., 4,530-50 ft., 5,040-90 ft., and 5,430-90 ft. The last core at 5,600 ft. showed oil staining. The Favel formation was encountered at 1,670 ft., Swan River at 2,110 ft., Jurassic 2,190 ft., Sundance 2,320 ft., Amaranth 2,810 ft., Gypsum Spring 2,930 ft. Spearfish 3,100 ft., Charles 3,200 ft., Madison 3,250 ft., Lyleton 4,080 ft., Moore shale 4,100 ft., Manitoban 4,160 ft., Winnipegosan (Devonian, not to be confused with Ordovician-Winnipeg) 4,530 ft., Elm Point 5,030 ft., Silurian red beds 5,210 ft., Stonewall 5,260 ft., Stony Mountain 5,550 ft., Red River 5,630 ft.

At the same time, the Rossburn area of West-Central Manitoba was being explored. A Jean Cleland wildcat found the Favel at 844 ft., Ashville at 935 ft., and Swan River at 1,247 ft. Three other tests were drilling in this vicinity at the end of 1949.

1950.—Early in the year the leasing program accelerated and the last 6 months saw an increase in drilling in the province. Red River Oils, Ltd., completed two shallow tests in eastern Manitoba where the sedimentary column is less than 1,000 ft. thick. One well was spotted some 16 miles northeast of Winnipeg; the other was located about 36 miles south and slightly west of Winnipeg.

Red-Man Oils, Ltd., drilled a structure test at the 1 Smith close to Russell town and not far from the Saskatchewan border, and Manitoba Gas & Oil 2 Coutts (another natural-gas search) was completed near Brandon city limits, further in-province. An electric log, run at this latter test, reflected some prospects of porous zones.

California Standard Co.'s Hartney well reportedly had oil stains in cores. This was the first wildcat operation based on seismic interpretation in the province. It was located about 25 miles northeast of the Souris Valley ventures, and 65 miles southeast of the new Virdin area.

Two more small-bore stratigraphic tests were put down by Red-Man in the Rossburn area; a remote exploratory well (1 Whiteside) was drilled near Badger in southeastern Manitoba; Red River completed the 1 Hepner, a shallow diamond-drill hole, southwest of Winnipeg; late in the year Souris Valley was drilling at an interesting wildcat near Coulter.

1951.—The Coulter test, 1 Downey, was suspended until May when deepening operations were begun. The first drill-stem test, open 1½ hours, in the Madison at 3,221-28 ft., recovered 30 ft. of slightly oil-cut drilling mud with no salt water. A core from the same interval had spotty oil indications. Another drill-stem test in the Mississippian at 3,234-46 ft. had 120 ft. of slightly gas and oil-cut fluid, 240 ft. of gas and oil-cut mud, and 330 ft. of salt water.

Porosity was reported to be good, and there it was believed that water intruding from the bottom of the interval could be squeezed off. The well went to 4,881 ft. to contact with the Devonian equivalent, and 5½-in. casing was set on bottom. Electric log run to that depth found good porosity, and cuttings from the Devonian at 4,853-81 ft. showed oil saturation. The well has been plugged back to 3,200 ft. for testing back up the hole. While it has not proved commercial production, this test is the first confirmation of the presence of oil in tight porosity in Manitoba. The following tops were logged: Boyne 1,300 ft., Favel 1,660 ft., Ashville 1,780 ft., Swan River 2,080 ft., Jurassic 2,260 ft., Spearfish 3,070 ft., Madison 3,222 ft.

The first production of free oil came in at California Standard 15-18 Daly, 13 miles east of the Saskatchewan border and 8½ miles west of Virden. This well reached basement at 5,368 ft. An open interval (in a Paleozoic limestone believed to be Mississippian) between concrete plug at 2,340 ft. and 7-in. casing landed at 2,200 ft. was acidized, and operator swabbed about 3 bbl. of fluid per hour in 140 runs. Gravity of the oil was between 30°-35°, and water cut approximated

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30 per cent. The discovery was placed on pump and recovered about 30 bbl. of fluid daily (15 bbl. of oil; water cut from 50-60 per cent). One report said the gas-oil ratio was high. An oil show was also rumored at 2,600 ft. Before the well was shut in it made 10 bbl. of oil and 20 bbl. of water per day.

A follow-up has been drilled by the same operator, 1,300 ft. southeast of the strike. The 10-18 Daly is bottomed at 2,334 ft. with 7-in. casing set at top of the pay at 2,220 ft. The well was acidized, swabbed to clear the formation, and developed a potential of 8-9 bbl. per day. Production testing continued, building up a steady yield of 9-10 bbl. of net oil per day, water cut 15-30 per cent.

At the close of the first half of this year, three more dry holes and two new operations had been announced. Red River finished the 2 Hepner southwest of Winnipeg, in the vicinity of two previous failures; Imperial Oil, Ltd., completed its first wildcat in Manitoba, 6 miles northeast of Birtle. This well stopped in granite 250 ft. short of its 4,500-ft. objective without finding any oil or gas indications. Immediately the company drilled the 1 Madeline near the Saskatchewan border, approximately 22 miles northwest of the 1 Birtle and 50 miles northwest of the Virdin successes.

In the discovery area, California Standard continued coring and testing below 2,500 ft. at its 7-12 Daly, third prospective producer.

About 5 miles northwest of the three "oil wells," California Standard has located the 8-29 West Daly, and Imperial has staked a 4,000-ft. test, the 1 Foxwarren, 10 miles northeast of the Madeline failure in the Russell-Rossburn area.

In the enthusiastic leasing rush throughout the basin, following the 15-18 Daly strike, more than 1,600,000 acres have been leased in the Manitoba discovery area, with the following companies especially active in that sector: Imperial Oil, Ltd.; British American Oil Co., Ltd.; Royalite Oil Co., Ltd.; Canadian Superior Oil Co. of California, Ltd. (previously Rio Bravo Oil Co.); Souris Valley Oil Co.; California Standard Co.; and Union Oil Co. of California.

Over in the United States, 78 per cent of North Dakota is now under commitment, with new activity centering around the northern side of the basin in Bottineau, McHenry, Pierce, and Rolette counties—all along the international boundary. Companies with holdings in the state include Union Oil Co. of California; Signal Oil & Gas Co.; Hancock Oil Co.; Shell Oil Co.; Standard Oil Co. of Ohio; Standard Oil Co. of Indiana; Standard Oil Co. of California; Amerada Petroleum Corp.; Pure Oil Co.; Continental Oil Co.; Magnolia Petroleum Co.; Carter Oil Co.; Plymouth Oil Co., and various independents.

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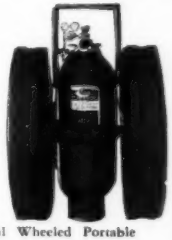

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Fig. 1—Loading drill pipe after completing another oil well in Mount Hope oil field, Logan County, Colorado: scene at Rig No. 17 of Shell Oil Co.

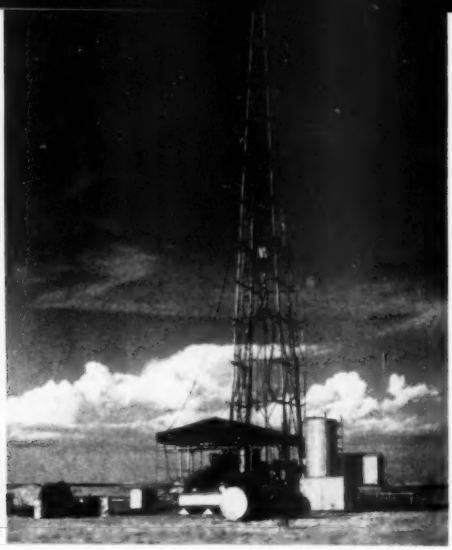

Fig. 2—Drilling rig at Shell Oil Co. 4-B C. F. Green, in Mount Hope field, Logan County, Colorado.

Drilling Through Bentonitic Shale

Shell Oil Co. conquered considerable hole trouble in thick Cretaceous shale sections in northeastern Colorado by revamping rig, changing hole size and liners, and boosting annular mud velocities.

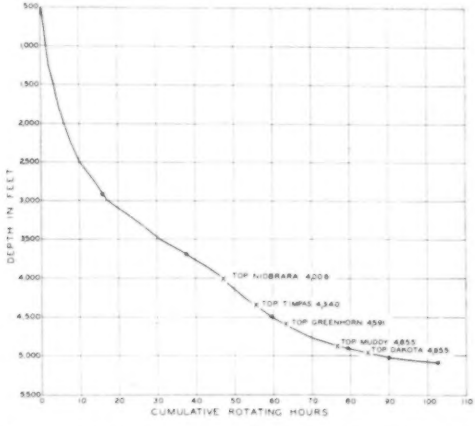

Fig. 3—Penetration curve for Shell Oil Co. 7-A Green, "D" sand oil well in Mount Hope field, Logan County, Colorado.

A TOUGH drilling problem in penetrating thick sections of bentonitic Cretaceous shales was solved by Shell Oil Co. in Mount Hope oil field of Logan County, Colorado, in the vast Denver-Julesburg basin by revamping rig, changing hole size and liners, and boosting annular mud velocities. An analysis of the problem and how Shell handled it is here discussed.

Bentonitic Shale Problem

Considerable hole trouble was encountered by Shell Oil Co. in drilling the first two wells in Mount Hope field. This condition was due primarily to the swelling and sloughing effect of the bentonitic Cretaceous shales. In an effort to keep the hole clean, high mud viscosities in the order of 60 to 65 seconds (Marsh funnel method) were maintained. Although high mud viscosities alleviated the condition, they did not prove a satisfactory solution. For example, servicing crews made three attempts as "A"-1 Green well before a successful run could be made on the Schlumberger sonde. Moreover, the hole was conditioned between each run attempt.

The first two wells drilled in the field, "A"-1 and "A"-2 C. F. Green, were drilled by company rig 17 utilizing a 12-in. pump and 3½-in. drill pipe. Hole size of the former well was 7⅞-in. and the latter was 6¾-in. Annular mud velocities in these two wells averaged 158 and 236 ft. per minute respectively.

Rig remodeled.—In an effort to drill through bentonitic shale, Shell drill-

TABLE 1—EFFECT OF DRILL PIPE AND HOLE SIZE DIAMETERS, PUMP SIZING ON ANNULAR MUD VELOCITIES—SHELL OIL CO. RIG 17, MOUNT HOPE OIL FIELD, LOGAN COUNTY, COLORADO

Well—	Bore-hole diameter (in.)	Drill-pipe diameter (in.)	Pump dimensions: Stroke (in.)	Pump dimensions: Liner (in.)	Average slush pump volume (g.p.m.)*	Average annular mud velocity (ft./min.)	Avg. trip time (hours)
"A"-1 Green	7⅞	3½	12	6¾	321	158	3.5
"A"-2 Green	6¾	3½	12	6¾	321	236	3.1
"A"-3 Green	7⅞	4½	14	7¼	425	250	2.9
"A"-4 Green	7⅞	4½	14	7¼	425	250	2.8

*Calculated at 90 per cent volumetric efficiency.

ing personnel redesigned the rig. Stroke on the mud pump was changed from 12 to 14 in., also 7¼-in. liners were used instead of 6¾-in. as formerly. Thus annular mud velocity was boosted to an average of 250 ft. per minute.

Drill pipe was changed from 3½ to 4½ in. o.d. Hole size for the next two wells was 7⅞ in. and A-3 and A-4 C. F. Green. The net result was that hole troubles were eliminated. Crews were then able to employ a mud of a lower viscosity in the order of 40 seconds Marsh funnel method. Lower mud viscosity is desirable from the standpoint of lower mud costs and a higher penetration rate.

Drilling Practices

Surface hole.—Pilot bit with three replaceable side cutters is employed for cutting surface hole to a depth of 350 ft. The 8⅝-in. 32-lb. surface pipe is set at that depth and 175 sacks of cement placed behind the pipe.

At that depth, hole is reduced and a 7⅞-in. bit used from 350 to 5,300 ft., the latter depth takes the well through the Dakota which includes the "J" sand objective, the producing oil reservoir. Long string of 4½-in. pipe is set on bottom and 150 sacks of cement placed behind the pipe.

Bit weights.—Weight of the entire string is carried on the bit to drill the 350-ft. surface hole; the rotary table is turned at from 150 to 175 r.p.m. Interval from 350 to about 2,500 ft. is drilled with a weight of 15,000 lb. on the bit; rotary-table speed ranges from 100 to 150 r.p.m. From 2,500 ft. to total depth, weight on bit is increased to as much as 30,000 lb. when possible and rotary speeds are held in the range mentioned immediately above.

Crooked-hole condition.—Only Shell well to experience serious hole deflection was 2 Green where the hole deviation rose to as high as 5°. To correct this condition, bit weight was reduced from 30,000 to 4,000 lb. while straightening.

Drill collars.—For the surface hole, one 8-in. and three 6-in. drill collars are picked up and remainder of the string is made up of 4½-in. o.d. 20-lb. per foot external flush drill pipe with Hydril joints.

In cutting the 7⅞-in. hole from 350 ft., three 30-ft. 6-in. o.d., 2¼-in. i.d. drill collars are used with 4½-in. A.P.I. regular connections. In addition, 1,050 ft. of 4½-in. external flush drill pipe is used as described above; remainder of the string is 16.6-lb. per foot drill pipe with internal-flush tool joints.

Flush-Joint Drill Pipe

The 4½-in. external flush-joint drill pipe is often run in compression so that its weight supplements that of the drill collars. This practice was started first in North Texas in 6¾-in.-diameter holes where the pipe

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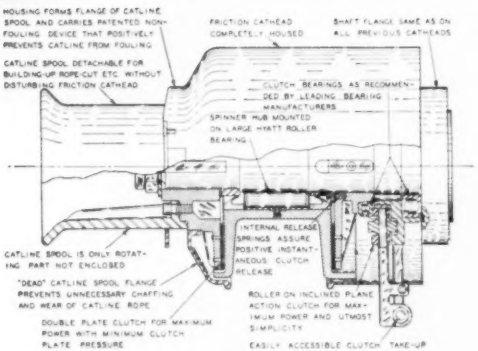
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was run above three 5-in. drill collars. The method proved successful in elimination of drill-collar fishing jobs and in the reduction of bottom-hole tool-joint wear which was severe in that area. The pipe was shipped to Colorado with Rig 17 and is still used to advantage; however 5½-in. o.d. drill pipe would be optimum size for the large 7⅞-in. hole size. More than 73,000 ft. of hole has been drilled with this pipe without a joint failure.

Weight supplier. — Briefly, advantages and disadvantages of using this flush-joint drill pipe as a weight-supplying element in the string are as follows:

Advantages:

1. Drill pipe is easier to fish, compared to 5½ or 6-in drill collars or 6-in. o.d. tool joints.
2. Fewer failures are known, compared to the equivalent weight in drill collars.
3. Bottom-hole tool-joint wear is reduced, compared to concentrating weight at bottom of string and running 6-in. o.d. tool joints close to bottom.

Disadvantages:

1. Use of lifting plugs is required.
2. One extra change of elevators is needed when making trips.
3. Restriction to mud flow through drill string is increased slightly, compared to 4½-in. drill pipe and 6-in. drill collars.
4. Theoretically, there should be excessive hole whip because external flush-joint drill pipe section is carried in compression. (There are no case records to substantiate this theory.)

Centralizers and Scratchers

Three scratchers are placed on the shoe joint and the remaining 15 are placed 20 ft. apart. Pipe is reciprocated while cement slurry is being run. Temperature survey is run prior to a dry formation test.

Perforations.—Four jet shots of 10-g. size per foot is Shell practice. After the well is perforated, 2-in. upset tubing is run and the well swabbed into production.

Completion Costs Reduced

Significant reductions have been brought about by Shell Oil Co. in completion costs by (1) elimination of coring, (2) elimination of open-hole formation testing, (3) moving-off rotary after second cement plug is down and (4) perforating for production with service truck with cable tools over the hole.

TABLE 2—BIT RECORD

(Shell Oil Co. "A"-7 Green, Mount Hope field, Logan County, Colorado)

Hole size (in.)—	From (ft.)	To (ft.)	Feet per bit
$10^{3}/_{4}$	0	350	350
$7^{7}/_{8}$	350	2,915	2,565
$7^{7}/_{8}$	2,915	3,700	783
$7^{7}/_{8}$	3,700	4,491	791
$7^{7}/_{8}$	4,491	4,890	399
$7^{7}/_{8}$	4,890	5,018	128
$7^{7}/_{8}$	5,018	5,079	

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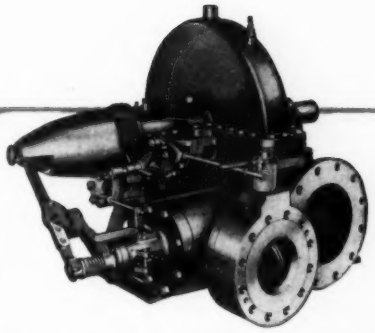
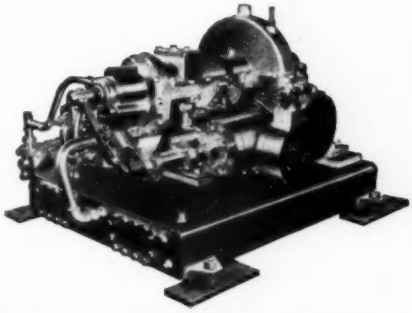
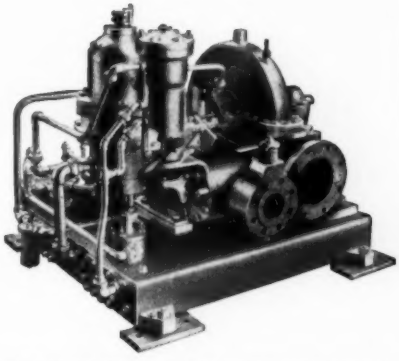


Shaft-Type Governor. For narrow speed-range applications, this governor automatically positions the steam admission valve to control turbine speed within close limits—*6 to 8% speed regulation.*



Hydraulic-Orifice Governor. For wide speed-range applications such as drives for fans, blowers, and compressors —*3-to-1 speed-adjustment range; 6% speed regulation.*



Vertical Oil-Relay Governor. For narrow-range precision-control applications such as drives for generators, pumps, blowers and compressors—*33⅓% speed-adjustment range; 4% speed regulation.*

J-50527

Fig. 1—(Above) Place-fix map showing location of Wellman oil field, Terry County, Texas, and its relationship to other Pennsylvanian reefs.

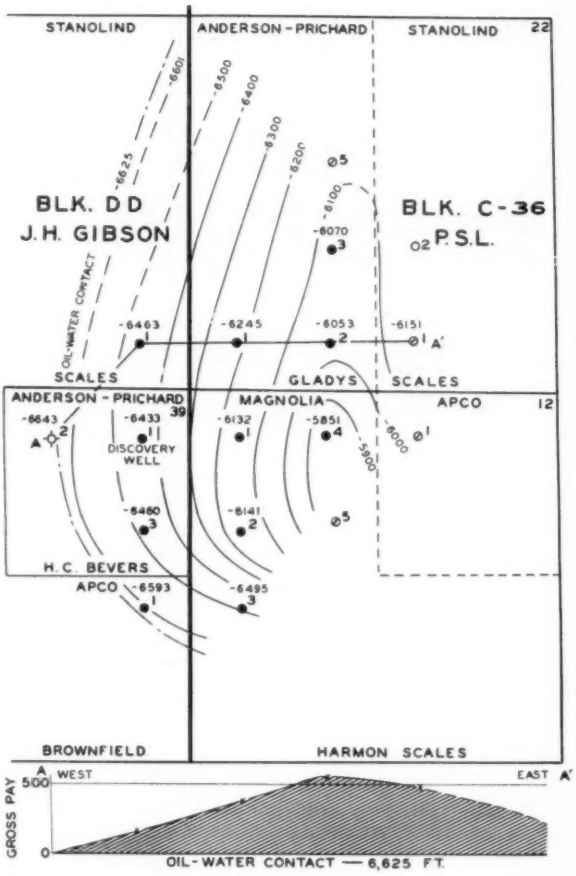


Fig. 2—(Right) Subsurface structural contour map of Wellman oil field contoured on top of the Wolfcamp reef. Contour interval is 100 ft. Below map is shown west-east cross section showing development of Wolfcamp reef above an oil water contact of 6,625 ft. subsea.

High productivity indexes, a strong water drive, and gross pay sections of as much as 768 ft. point to rich spot in heart of Permian basin; 11 deep wells have 56,000-bbl. monthly allowable.

RICH REEF: Wellman Pool, Terry County, Texas

WELLMAN field, 10 miles southwest of Brownfield in West Texas, now has eleven 10,000-ft. oil wells on production from one of the richest reef sections yet logged in the Permian basin. Gross pay sections in the Wolfcamp (Permian) series range up to 768 ft. above the water table. Four rigs are active in development of this small but thick reef development.

Reservoir performance for this year-old field has been excellent and bottom-hole-pressure decline has been negligible on key wells surveyed, considering per-well withdrawal rates of as high as 236 bbl. per producing day. Productivity indexes conducted on one well remained as high as 1.9 bbl. of oil per day per psi. at a 1,968-bbl. rate. Reservoir data suggest a strong water drive is operative. Ultimate area is expected to embrace 1,320 acres of which 440 attributable acres have been proved.

The now but partly defined Wellman field was originally drilled to test a geophysical anomaly in the Ellenburger dolomite and two tests drilled to the deeper pre-Pennsylvanian objectives have proved dry. All completions to date are in the Wolfcamp reef (Permian). There are no limitations to the field with exception of Anderson-Prichard Oil Corp. 2 H. C. Bevers, NW NE Section 39, Block DD, J. H. Gibson Survey.

Regional importance.—Wellman field is situated in the middle of a group of deep-seated lower Permian reef features in the northern limb of the Permian basin. Genetically, it is not related to the Canyon (Pennsylvanian) reef development which occurs on the eastern shelf of the basin in Scurry and adjoining counties.

Reef reservoirs productive from the Wolfcamp series in the vicinity of the Wellman field include:

Reservoir—	Depth range	No. of oil wells	Gravity of produced oil, °A.P.I.
Wellman	9,392-9,870	11	42.5
Adair-Wolfcamp	8,500	15	43
Shafter Lake-Wolfcamp		26	44.1

Oil Allowables

Discovered on July 9, 1950, Wellman operated under a discovery allowable of 200 bbl. per day for the first five wells. On completion of the fifth well, allowable was cut to 162 bbl. per day (subject to shutdown days). On expiration of discovery allowable on January 17, 1951, Anderson-Prichard engineers obtained an increase in basic allowable to 300 bbl. per day per well subject to shut-

WELLMAN OIL FIELD, TERRY COUNTY, WEST TEXAS

METHOD OF EXPLORATION: Reflection seismograph.
DATE OF FIRST OIL PRODUCTION: July 1, 1950.
DISCOVERY OIL WELL: Anderson-Prichard Oil Corp. 1 H. C. Bevers, NE NE Sec. 39, Blk. DD, J. H. Gibson Survey, Terry County, Texas; initial potential of 2,280 bbl. of 42.5° A.P.I. gravity oil through 1-in. choke on 2-in. tubing from Wolfcamp (Permian) reef topped at 9,712 ft. (—6,433), total depth 9,813 ft. (—6,537).
PRODUCTIVE ZONE: Wolfcamp reef ..... 9,392-9,870 ft.
PRODUCTIVE ACREAGE: Status as of June 1, 1951.
Attributable acreage 440
PRODUCTION ALLOWABLES:
Basic allowable, bbl. per well per calendar day 300
Total field allowable, March 1951, producing-day basis 56,000
WELLS:
Number of flowing oil wells (July 1, 1951) 11
Deepest well drilled: Anderson-Prichard Oil Corp. 2 H. C. Bevers, NW NE Sec. 39, Blk. DD, J. H. Gibson Survey, total depth 10,700 ft. in Ellenburger dolomite topped at 10,650 ft., dry.
CRUDE-OIL OUTLET:
Stanolind Pipe Line Co. by trucks.
OPERATORS:
Anderson-Prichard Oil Corp., Stanolind Oil & Gas Co., Magnolia Petroleum Co.

down. Currently, the total field allowable is 57,000 bbl. per month based on producing days.

Field Development

Wellman field was discovered by Anderson-Prichard Oil Corp., Oklahoma City, 1 H. C. Bevers, NE NE Section 39, Block DD, J. H. Gibson Survey, a rank wildcat located in southern Terry County, Texas. Originally, the well was drilled to a total depth of 9,811 ft. in Wolfcamp reef topped at 9,712 ft. (—6,933). Perforations were made through casing from 9,712-26 ft., 9,734-92 ft., and from 9,797-9,805 ft. After tubing was run, the well made a 6-hour flow test of 572.5 bbl. of 42.5° A.P.I. gravity through a 1-in. choke on 2-in. tubing, to draw a daily potential of 2,280 bbl. Flowing tubing pressure was 175 psi. during the first hour and 190 psi. during the remainder of the test period. Gas-oil ratio was 470 cu. ft. per barrel.

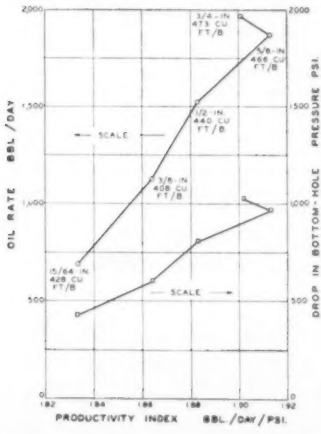


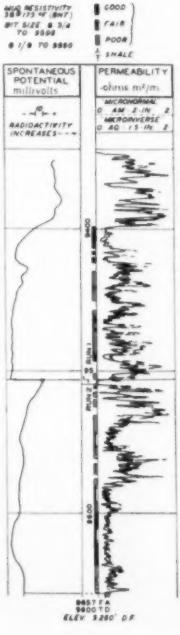
Fig. 3—Graph of productivity index test data conducted July 22-24, 1950, at Anderson-Prichard Oil Corp. 1 H. C. Bevers, NE NE Sec. 39, Blk. DD., J. H. Gibson Survey.

Discovery operators drilled the west offset, 2 H. C. Bevers, topped reef at 9,955 ft., 250 ft. low to discovery but found salt water in the Wolfcamp reef. Deepened to 12,700 ft., the well found sulfur water in Ellenburger dolomite topped at 12,650 ft. and finaled at 12,700 ft.

East offset to discovery well, Magnolia Petroleum Co. 1 Harmon Scales, NW NW Section 12, Block C-36, PSL, topped reef at 9,420 ft. (—6,132 ft.), 301 ft. high to the discovery and found excellent production in the reef.

More recently, the east 40-acre stepout from the above well found the reef still 281 ft. higher, marking a maximum reef development of 768 ft. of gross pay above the established oil-water contact of —6,625 ft.

Productive limits have been indicated only on the west and southwest sides of the field. *(Cont'd on page 295.)*



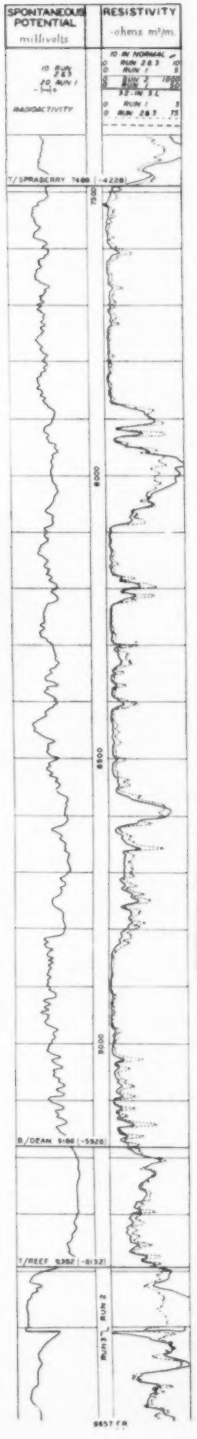


Fig. 4—(Right) Type electric log for Wellman oil field, showing formations extending from top of Spraberry found at about 7,500 ft. to below 9,600 ft. in the Wolfcamp series at Magnolia Petroleum Co. 1 Harmon Scales, NW NW NW Section 12, Block C-36 P.S.L. Survey, total depth, 9,660 ft. completed about October 25, 1950. Mud resistivity is 0.7 ohms m²/m. at 75° F. and electrode spacings are AM = 10-in., AO = 32-in., L.S. and AO = 19-ft. Lat. (Below) MicroLog survey of same well from 9,350 ft. to 9,660 ft. total depth.

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Diesel Rigs

Contractors.—Among the drilling contractors represented at Wellman are Parker Drilling Co., Tulsa; Murray Drilling Co., Houston; and Brahaney Drilling Co., Midland, Tex. Stanolind Oil & Gas Co. has a company rig active on its development.

Standard 136-ft. derricks are used with 30 by 30-ft. base. Parker uses 8-ft. substructures, Murray Drilling Co. 12-ft. units.

Hole size and casing.—Parker practice calls for cutting a 17½-in. hole to 300 ft. where the 13⅜-in. surface pipe is set; 350 sacks are placed behind the pipe. At this point, the hole is reduced to 12¼ in. which is cut to 4,750 ft.; at the latter depth 9⅝-in. pipe is set and 3,000 sacks put behind the pipe. From that level to casing point, a 8¾-in. hole is cut.

Deviation surveys.—Contractors are required to run deviation surveys every 200 ft. Contract calls for holding bore hole to a maximum deviation of 5°. At Wellman, contractors have experienced little trouble in keeping hole straight, except for drilling through Spraberry and pre-Dean sections where maximum deviation rises from 1° up to 3°. This is shown from the typical deviation record prepared by Parker Drilling Co., covering its 3 H. C. Bevers drilled by Anderson-Prichard Oil Corp., SE NE Section 39, Block DD, J. H. Gibson Survey.

TYPICAL DEVIATION RECORD—WELLMAN OIL FIELD

Depth (ft.)—	Deviation (deg.)
1,600	½
2,335	¼
2,712	½
4,130	1
5,055	1
6,258	¾
6,535	1
6,900	¾
7,834—Top Spraberry section	
8,355	2¼
8,470	1¾
8,680	2
8,828	2½
8,858	3
9,374—Base Dean series	
9,385	1
9,450	1½
9,528	1¾
9,645	2
9,745	3
9,755—Top of Wolfcamp reef	
9,920—Total depth	

Long string.—Open hole is carried from 4,750 ft. to about 9,800 ft. A string of 5½-in. casing is set through the upper part of the reef section and cemented with 2,000 sacks.

Completion method.—After cement is allowed to set, gun perforator is run opposite upper part of reef section. Shot density employed is four per foot. Two-inch tubing is run and the well swabbed into production.

Parker has cut as much as 9,920 ft. of hole in 81 days using 93 bits.

Reservoir Behavior

Slight pressure drop.—Bottom-hole-pressure surveys conducted by Anderson-Prichard on four wells on intervals from July 24, 1950, to April

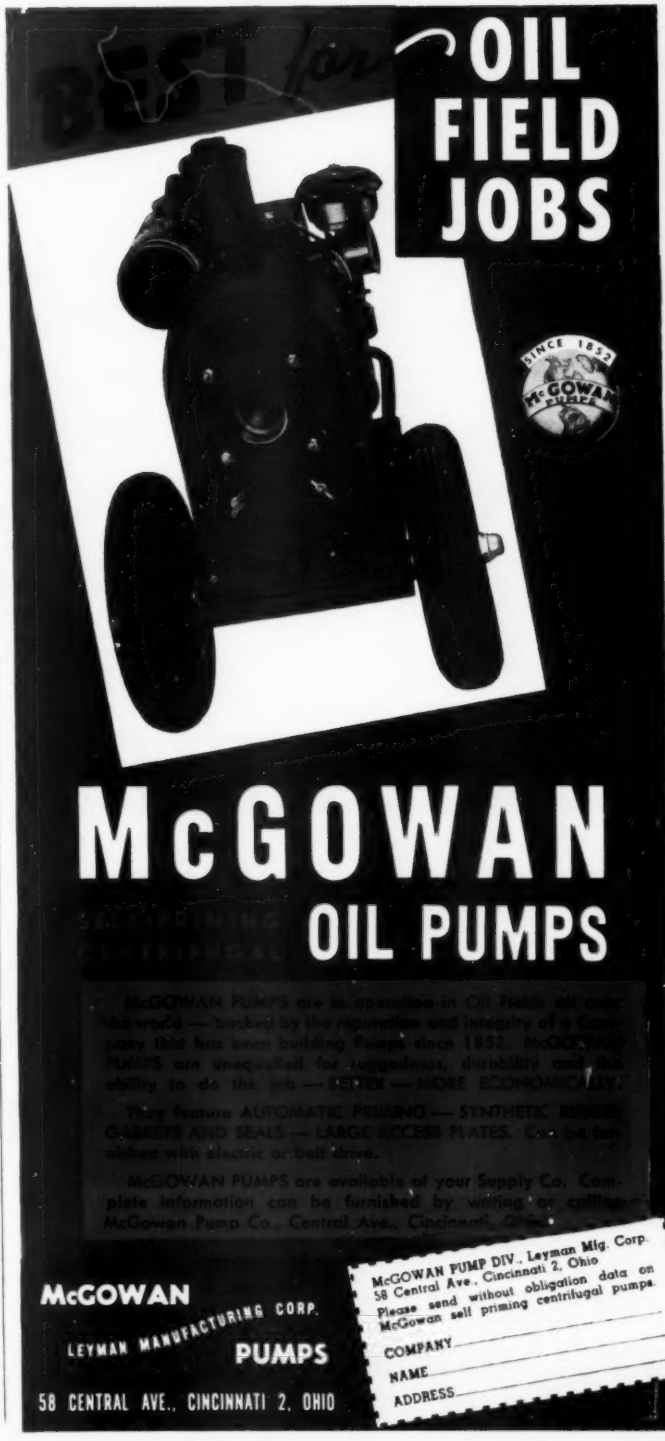
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TABLE 3—CORRELATION OF SUBSURFACE GEOLOGICAL MARKERS, WELLMAN FIELD, TERRY COUNTY, TEXAS

Operator and well—	Section	Block	Survey	Elev.	Top correlation marker*	Top of Spraberry	Base of Dean	Top of reef	Total depth
Anderson-Prichard:									
1 H. C. Bevers	39	DD	J. H. Gibson	3,277	—1,543	—4,327	—6,077	—6,433	—6,536
2 H. C. Bevers	39	DD	J. H. Gibson	3,297	—1,577	—4,386	—6,193	—6,643	†—9,403
3 H. C. Bevers	39	DD	J. H. Gibson	3,295	—1,527	—4,339	—6,079	—6,460	—6,625
1 Brownfield	39	DD	J. H. Gibson	3,277	—1,544	—4,359	—6,160	—6,593	—6,607
1 G. Scales	22	C-36	PSL	3,291	—1,504	—4,281	—6,007	—6,245	—6,599
2 G. Scales	22	C-36	PSL	3,293	—1,485		—5,925	—6,053	‡—8,207
3 G. Scales	22	C-36	PSL	3,297	—1,500		—5,926	—6,070	—6,520
Magnolia Petroleum Co.:									
1 H. Scales	12	C-36	PSL	3,260	—1,487	—4,228	—5,926	—6,132	—6,405
2 H. Scales	12	C-36	PSL	3,281		—4,249	—5,947	—6,141	—6,414
3 H. Scales	12	C-36	PSL	3,280	—1,534		—6,119	—6,495	—6,509
4 H. Scales	12	C-36	PSL	3,283	—1,460	—4,200	—5,762	—5,857	—6,127
Stanolind:									
1 Scales	22	C-36	PSL	3,294				—6,151	
1 Scales	14	DD	J. H. Gibson	3,281	—1,548	—4,344	—6,103	—6,463	—6,601

*Correlation marker near top of San Andres. Additional markers on deeper geological horizons. †Top Strawn —7,535 ft.; top Atoka —8,180 ft.; top Mississippian lime —8,795 ft.; top Woodford —9,273 ft.; top Siluro-Devonian —9,366 ft. ‡Top Strawn —7,547; top Atoka —8,172 ft.

TABLE 2—OIL ALLOWABLE VS. PRODUCTION, WELLMAN FIELD, TERRY COUNTY, TEXAS

(Source: Railroad Commission of Texas)

1950—	No. of producing wells	Total allowable— Daily	Total allowable— Monthly	Reported prod.— Daily	Reported prod.— Monthly
July	1	200	6,200		
August	1	200	6,200	201	6,242
September	1	200	6,000	198	5,992
October	2	300	9,000	290	9,020
November	4	794	23,800	395	11,847
December	4	800	24,800	812	25,175
1951—					
January	5	875	27,140	900	27,828
February	6	695	19,440	696	19,472
March	8	1,362	42,291	1,360	40,392
April	8	1,900	57,000	1,868	56,056

12, 1951, show slight drop in average bottom-hole pressure corrected to datum of —6,519 ft. The range was from 4,108 to 4,152 psig. as of April 12, 1951, on four wells as compared with the maximum observed datum pressure of 4,178 psig. observed on October 12, 1950.

BOTTOM-HOLE PRESSURE SURVEY

(Anderson-Prichard Oil Corp. Properties—Test Date: April 13-14, 1951—Datum —6,519 ft.)

Well and location—	Observed static bottom-hole pressure (psig.)
1 H. C. Bevers, NE NE Sec. 39	4,152
3 H. C. Bevers, SE NE Sec. 39	4,132
1 Brownfield, NE SE Sec. 39	4,108
1 Gladys Scales, SW SW Sec. 22	4,150

Gas-oil-ratio survey.—Produced gas-oil ratios averaged 471 cu. ft. per bbl. for a group of four Anderson-Prichard wells tested during a survey taken April 9 to 12, 1951; range was from 432 to 536 cu. ft. per bbl. Values were as follows: 1 H. C. Bevers, 481 cu. ft. per bbl.; 3 H. C. Bevers, 432 cu. ft. per bbl.; 1 Brownfield, 536 cu. ft. per bbl., and 1 Gladys Scales, 435 cu. ft. per bbl. Solubility gas-oil-ratio data from bottom-hole-sample data is 442 cu. ft. per bbl.

TABLE 1—RESERVOIR STATISTICS

(Wolfcamp Reef Reservoir, Wellman Field, Terry County, Texas)

1. Highest productive structural contour, ft. subsea	*—5,851
2. Oil-water contact, ft. subsea	†—6,525
3. Present productive relief, ft.	768
4. Average producing depth, actual, ft.	9,631
5. Average gross pay section above oil-water table	382
6. Spacing pattern, acres per well	40
7. Maximum observed reservoir pressure (datum —6,519 ft.), psig.	‡4,178
8. Solution gas-oil ratio, original, cu. ft. per bbl.	422
9. Gravity of residual oil, °A.P.I.	43
10. Range of porosity, per cent	3.05 to 7.65
11. Average porosity, per cent, 11 cores, per cent	5.54
12. Range of horizontal permeability, md.	0.4 to 58
13. Average horizontal permeability of cores above 1 md., 10 cores	14.68

*Magnolia Petroleum Co. 4 Harmon Scales, NE NW Sec. 12, Blk. C-36, PSL Sur. †Established at —6,625 to —6,643 ft. in Anderson-Prichard 3 H. C. Bevers. ‡Observed at Anderson-Prichard Oil Corp. 1 H. C. Bevers, NE NE Sec. 39, test on October 12, 1950.

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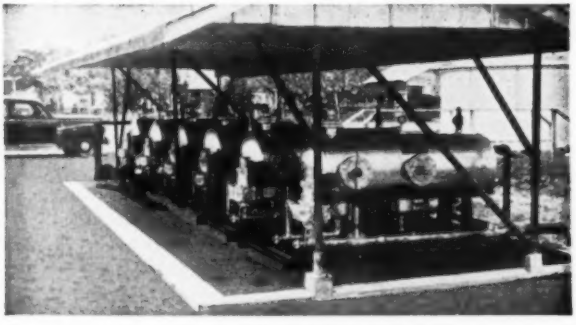

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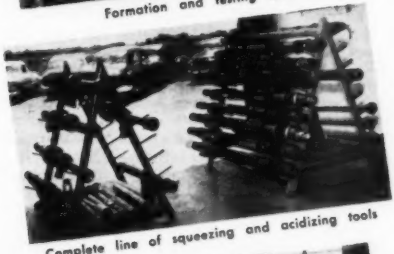

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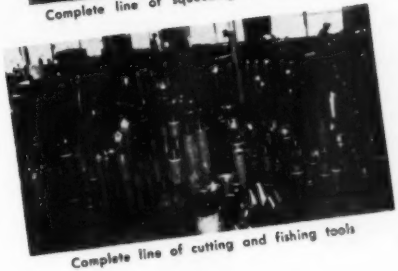

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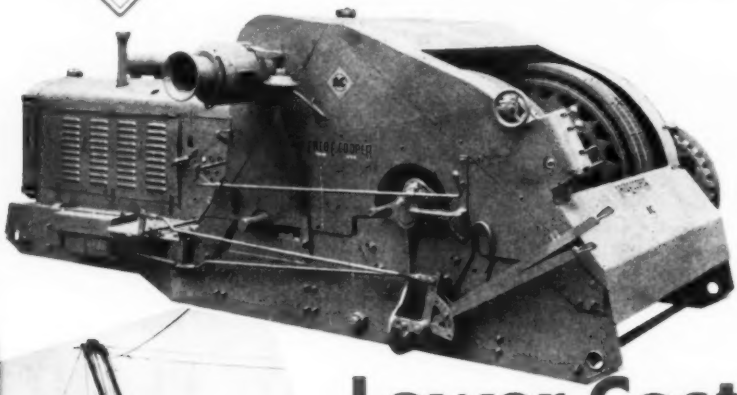

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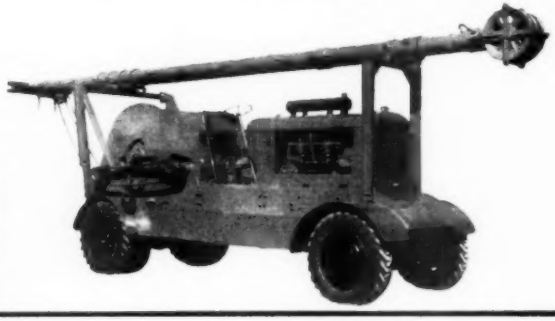

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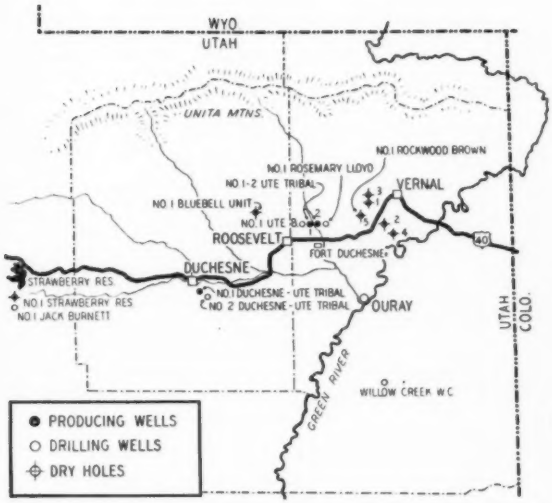

Fig. 1—Oil-field map of portion of Uinta basin, northeast Utah, showing location of drilling wells in Duchesne and Roosevelt fields, seeking Eocene (Tertiary) oil reservoirs.

Fig. 2—Carter Oil Co. and Continental Oil Co. 1 Duchesne Unit, discovery well of the new Duchesne oil field producing from the upper Wasatch formation.

Tough Drilling in Fractured Tertiary Rocks

Lost circulation and extremely slow penetration rates feature drilling in highly fractured oil reservoirs in Uinta basin of northeastern Utah

LOST circulation and extremely slow penetration rates are the drilling problems encountered in development of highly fractured oil and gas reservoirs in several new fields in the Uinta basin of northeastern Utah. These problems are common in the new Red Wash field, Roosevelt field, Duchesne pool, and the Gusher area.

Open-hole completions. — Standard practice is to set long string on top of first oil pay in the basal Green River formation, drill ahead with diamond core heads, drill-stem test each zone, and finally complete by swabbing the well into production. In addition to regular procedure of running electrical and radioactivity logs, special applications are being made of caliper surveys which show correlation of hole enlargement with pay zones, and temperature surveys which point up pay development.

Loss of drilling fluid, common in this fractured area, can be held in balance by maintaining mud weight within certain limits. General practice is to hold water loss at as low a value as is possible to prevent contamination of formations by mud filtrate. Some difficulty has been encountered in high sand content cutting out slush-pump liners.

Tough digging. — Drilling in the Uinta basin is complicated by hard, abrasive Tertiary sediments which literally eat up drilling bits. Penetration rates average around 4 ft. per hour with a weight on bit of 30,000 lb. Bit performance for 9-in. bits in the Green River formation at a depth of 7,500 ft., with an average rotary-table speed of 70 r.p.m., ranges from only 30 to 40 ft. At times, rates of penetration of 9-in. rock bits have dropped to only 1 ft. per hour with less than 10 ft. of formation cut per bit used.[1]

Red Wash Field

Discovery well.—With four rigs active, Red Wash field is the most active field development in the Uinta basin. Contract rigs are being used on a developmental program by The

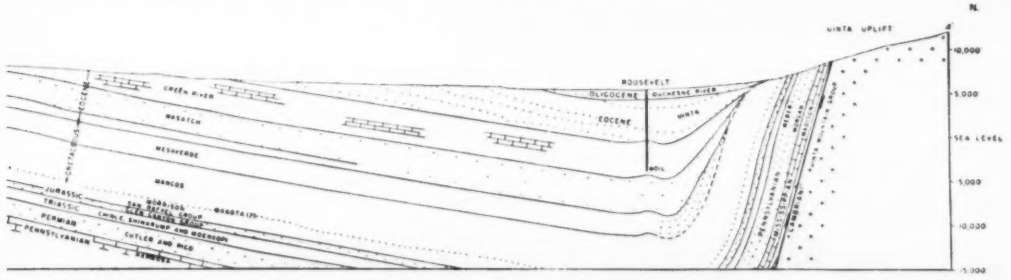

Fig. 3—Geologic cross-section of Uinta basin, Utah, along north-line line. (Courtesy American Association of Petroleum Geologists.)

California Co. extending along a 2-mile front of oil reservoirs lying in the Green River (Eocene) formation. All completions to date have been open hole, to test fractured oil and gas reservoirs.

The field-opener, 1 Unit, NE NE NE 26-7s-23e, was completed in open hole from pay at 5,249-70 ft. Earlier, the well was drill-stem tested at a total depth of 5,270 ft. with packer set at 5,249 ft., using a $\frac{3}{8}$-in. top-hole choke, and after testing tool was open for 61 minutes, the well flowed 34 -gravity oil after 17 stands of drill pipe were out of the hole. Pipe was set at 5,160 ft. and after cement plug was drilled, the well flowed on being swabbed five times. Flow rates were as follows: 148 bbl. of oil, 13 hours, $\frac{1}{4}$-in. choke, 950 psig. tubing pressure; 521 bbl. of oil, in 24 hours, $\frac{1}{4}$-in. choke; 305 bbl. of oil in 24 hours, $\frac{3}{8}$-in. Final test was 392 bbl. of oil in 24 hours through a $\frac{3}{8}$-in. choke on February 2, 1951.

Casing program.—On the discovery well, operators set 74 ft. of 20-in. conductor which was cemented with 110 sacks. The surface string was 1,500 ft. of $13\frac{3}{8}$-in. pipe cemented with 1,160 sacks. Long string was 7-in. set at 5,160 ft. and cemented with 600 sacks. Total rig time from move in to rig release date was 92 days.

First offset.—The diagonal northeast offset was next drilled at 2 Unit, SW SW SW 24-7s-23e. Several changes were made in the casing and cementing program. The conductor string was changed from 20-in. to 16-in. which was landed at 52 ft. and cemented with 50 sacks of cement. The surface string was changed from $13\frac{3}{8}$ to $10\frac{3}{4}$-in. and set at 1,014 ft. and cemented with 500 sacks. Long string remained unchanged at 7-in.; seat was 5,188 ft. Total rig time increased on No. 2 Unit over No. 1 Unit, being 101 vs. 92 days.

More reservoirs.—After finding gas in the zone where oil was logged in the discovery well, The California Co. cemented 7-in. casing at 5,188 ft. in No. 2 Unit and cored ahead, finding increased fractured section. On a 70-minute drill-stem test from 5,310-57 ft., it flowed 2,000 M.c.f. of gas per day with no oil. Following another drill-stem test from 5,364-5,416 ft. with tool open for 4 hours, gas rose to surface in 1 minute; when drill pipe was broken down, recovery was 4,000 ft. of 28 -gravity oil. Finally at total depth of 5,636 ft. it swabbed 154 bbl. of oil per day (in the basal Green River formation) and rig was released on May 29, 1950.

Third producer was a $\frac{1}{2}$-mile west extension at same interest's 3 Unit, C W 2 SW SE 23-7s-23e. At a total depth of 5,565 ft. with 7-in. casing set at 5,562 ft. the well pumped $69\frac{1}{2}$ bbl. of oil in 14 hours on the pump; it was still testing on last report.

Fourth producer and a $1\frac{1}{2}$-mile northwest extension was 4 Unit, C NE NE 22-7s-23e; it swabbed 325 bbl. of oil in 24 hours from a depth of 5,765 ft.; 7-in. pipe had been set at 5,763 ft.

Currently drilling are 5 Unit, SE NE NE 23-7s-23e, 6 Unit, C NE NE 21-7s-23e, and 7 Unit, NE NE NE 27-7s-23e.

TABLE 1—FORMATION RECORD, RED WASH OIL FIELD, GREEN RIVER (TERTIARY) OIL RESERVOIR, UINTAH COUNTY, UTAH—ELECTRIC LOG DETERMINATION
(The California Company)

	1 Unit	2 Unit
Duchesne River	0-400	0-400
Uintah	400	400
Green River	2,685	2,703
Wasatch	(*)	5,504
Total depth	5,270	5,632

*Not reached.

Roosevelt Field, Utah

Three rigs are currently active in Roosevelt field of Uintah County, which was discovered in mid-1949. The field, which established Tertiary oil possibilities in the large Uinta basin, was discovered on July 9, 1949, following a reflection-seismograph survey tested by Carter Oil Co. and Stanolind Oil & Gas Co. 1-A Ute-Tribal NW SW 21-1s-1e. The well was completed for an initial potential of

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1,633 bbl. of 33°-gravity and 90° F. pour-point oil in 24 hours with a gas-oil ratio of 350 cu. ft. per barrel. Green River formation was topped at 5,765 ft. and penetrated to 9,392 ft.

Second producer in Roosevelt field was completed east of the discovery and was completed in August 1950 at 2 Ute-Tribal, located in NW SE 21-1s-1e. Initial flowing potential was 439 bbl. of oil per day after acid treatment at a total depth of 9,392 ft. in Green River formation topped at 5,787 ft. The two Roosevelt field wells have produced to August 1, 1951, in excess of 400,000 bbl. of oil.

Current activity.—East of 2 Ute-Tribal oil well, Carter's 1 Rosemary Lloyd, C NW SW 24-1s-1e, (USM) is drilling below 8,020 ft. after logging several light gas showings. Surface pipe is 10¾-in. set at 806 ft.

One-half mile west of the discovery well, Carter is drilling below 6,500 ft. at 1-B Ute-Tribal, C NE SW 20-1s-1e (USM). The 16-in. surface pipe is set at 58 ft., and cemented with 74 sacks. Surface string is 10¾-in. pipe set at 815 ft. and cemented with 365 sacks. Carter operates a company rig Model 450 rig which is rated as capable of hoisting from 8,500 to 10,000 ft. of 4½-in. drill pipe when powered by 900 hp. Drum shaft is 8-in., jack shaft 6¾-in. and line shaft 6¾-in. The rig is equipped with a 142-ft. steel mast.

Between this latter well and Carter's 1 Bluebell Unit dry hole, Phillips Petroleum Co. has recovered 15 ft. of oil-saturated shale from 7,041-59 ft. carrying from 60 to 80 per cent saturation at 1 Leeton, C NE NE 24-1s-1w (USM). Phillips set 13⅜-in. surface casing at 517 ft. and cemented with 500 sacks. On last report, it is drilling below 8,087 ft.

Two miles north of the discovery well, Gulf Oil Corp. staked location for 1 Lynn, C SE SW 10-1s-1e.

Duchesne Field, Utah

Open-hole completion.—Early in July 1951 Carter Oil Co. and Continental Oil Co. completed the discovery well of Duchesne field in Duchesne County, Utah. The field opener, 1 Ute-Tribal, C SE NE 17-4s-4w, flowed 363 bbl. of oil in 36 hours and 12 minutes before being shut in. Producing formation is the upper Wasatch sediments comprised of interbedded sand and shale of Tertiary age; pay was from 7,490 to 7,549 ft. The long string was 7-in. pipe set at 7,486 ft. with 250 sacks. Earlier, a drill-stem test run at 7,490 to 7,549 ft. recovered 1,260 ft. of oil and gas-cut mud; at this level, the well kicked out 12-lb. mud. Surface string was 16-in. pipe set at 778 ft.; 625 sacks were placed behind the pipe.

Circulating string.—A special circulating jacket of 5-in. pipe was run to a depth of 3,916 ft. in order to facilitate producing the high-pour-point oil. The pour point is 100° F., 10° higher than the oil produced in Roosevelt field 30 miles to the northeast. Heated oil is circulated down the 5-in. pipe and up through the annulus between the 5 and 7-in. strings.

First offset.—One-half mile east of the discovery well, Carter and Continental are drilling the first offset at 2 Ute-Tribal, C SE NW 16-4s-4w. Surface string was 16-in. casing set at 815 ft. and cemented with 370 sacks. Coring started as shallow as 1,639 ft. in the Uinta formation. It is drilling ahead to the upper Wasatch reservoir found in the discovery well.

Gusher Area, Uintah County, Utah

Basal Green River reservoir.—One-half mile northwest of the noncommercial discovery in the Gusher area of Uintah County, The California Co. completed its 2 Unit, C SE SW 21-5s-19e on July 18, 1951. Conductor pipe was 74 ft. of 16-in. pipe cemented with 90 sacks. The surface string was 1,529 ft. of 10¾-in. pipe set at 1,529 ft. Originally, the well was drilled to a total depth of 10,500 ft. plugged back to 8,600 ft. pipe set and perforated in the 8,500-ft. zone. After acidization, it swabbed a very small amount of oil with water and was plugged and abandoned.

Reference

1. Polumbus, E. A., Jr., "Progress Report: Uinta Basin Development Activity," The Oil and Gas Journal, June 7, 1951, page 78.

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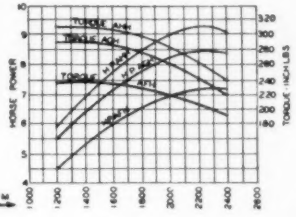

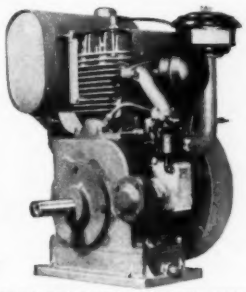

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	6.1 at 2600	7.2 at 2200	8.4 at 2200	9.2 at 2200
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Contractors and Operators Enjoy Harmonious Relationship

Contractors operate 88 per cent of U. S. drilling rigs, which indicates approval of their services

by R. B. McCloy*

A VERY harmonious relationship exists between oil-well contractors and operators. This relationship is attested by the fact that contractors operate 88 per cent of the drilling rigs in the United States. This percentage is appreciably greater than the 68 per cent of total rigs operated by contractors in 1935. This notable increase indicates approval by operators of the contractors' work.

The present harmonious relationship results from the cooperation of individuals attempting to complete a difficult, often hazardous, task in minimum time at a reasonable cost. The contractors are to be congratulated for the results obtained and progress made in the art of rotary drilling.

Bidding on Drilling Contracts

The first association between an operator and contractor is the opportunity to bid on a particular location. The obtaining of this opportunity is based largely upon previous experience by the operator or upon the contractor's reputation with the industry and among other operators when the operator does not have previous experience with the contractor. The opportunity to bid presents two problems: presentation of the request to bid by the operator, and development of a bid that will provide a profit and still be successful in getting the job.

To attempt the writing of a printed contract that will adequately specify the requirements for the drilling of a well in any area is practically impossible. In view of this fact, the operator should use a printed contract that states the basic conditions of operation and leave sufficient blank space so that those directly responsible for the operation can accurately describe the requirements for a specific location. The individual directly responsible for the drilling of a well should make every effort to consider anticipated conditions and incorporate the information in the proper blank spaces provided in the contract. When the contract is available in this form it should be used as a bid sheet. In this manner the contractor should know what is expected to satisfactorily fulfill a given operation to everyone's satisfaction.

Analyzing Cost Figures

When a contractor receives the opportunity to bid, he should review information from wells drilled in the area and analyze current cost figures to arrive at a realistic bid that will give an efficient operator some assurance of a fair profit. For an efficient contractor to be able to bid lower than a competitive contractor, it is necessary that the successful contractor drill the well faster than competitors, since operating costs for a given size rig are comparable among contractors. This is a point worth stressing.

For any given rig size there is a certain base operating cost regardless of who owns the rig. This base cost is composed of four items: (1) **overhead,** (2) **labor,** (3) **operating expense,** and (4) **depreciation.** When

*Division drilling superintendent, Stanolind Oil & Gas Co., Oklahoma City.

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you get down to this matter of drilling faster, that is a problem. Days spent fishing are not productive days and offer the contractor an avenue to increase efficiency. As an operating company, Stanolind Oil & Gas Co. drilled 555 wells in 1949, and the fishing jobs that have been encountered have been tabulated. Fishing jobs were in progres on almost every day of the year, and a large number of the fishing jobs are the result of so-called twistoffs.

Cut Down on Twistoffs

Practically all twistoffs are actually fatigue failures in one form or another. However, they will be described as twistoffs since that is the commonly used term. Many twistoffs can be eliminated by proper instruction of contractors' supervisory personnel and rig crews. If the crews are instructed on the care of handling tool joints and drill collars, many drill-string failures can be eliminated. Several manufacturers of tool joints and drill collars have prepared complete manuals on the care of handling drill pipe and tool joints, but the information has not been carried to the drilling crews that handle the drill pipe.

One common cause of drill-pipe twistoffs that has been known for many years but is still a common

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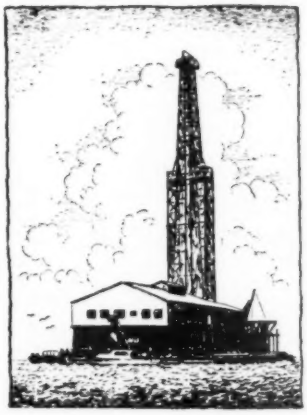

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occurrence is slip marks caused by the drill pipe turning in the slips. Slip marks will cause failure unless they are dressed down with a file and all sharp notches removed. Some crews have been instructed to watch for slip marks and remove them when observed.

By proper handling of drill pipe, tool joints, and drill collars, the life of the string can be increased many fold. It would appear that an excessive number of drill-pipe twist-offs still occur, although their cause and method of prevention is well known. The operator is vitally interested in the number of days spent fishing, since it ultimately is the expense of the operator, even though drilling is performed on a footage contract. The contractors could increase drilling efficiency by proper education of field personnel in care and maintenance of expensive drilling equipment. A great amount of information is currently available, but it has not been carried to those responsible with the actual handling of the equipment.

Contractors should keep a continuous record of daily progress for comparison with rigs of other contractors in the same area. Many times progress charts are kept, but no comparison is ever made against other rigs in the field, and no effort is made to eliminate the slow drilling encountered in certain sections of the hole. By proper use of progress charts, a contractor should be able to keep abreast of other contractors and should be able to determine the part of the hole in which additional effort should be made to accelerate drilling rate. Judicious use of time depth curves is of great value in decreasing cost and increasing profit to the contractor.

Care of Material and Supplies

It might be well to point out a common failing of many operators which places the contractor in an unfortunate position. On initial wells in a field, contracts are usually on a bid basis and thereafter on a field basis. On a bid basis the contract is given to the contractor that submits the lowest rate per foot balanced against a reasonable or low day rate. A contractor that is careful of the equipment and material supplied by the operator can actually drill a well and have it completed for a lower cost than a contractor who does not exercise such care but submits a lower price per foot.

Most contractors take good care of mud, cement, and casing provided by the operator, but some contractors do not provide adequate storage for these materials, with the result that much of the material is lost due to damage. Operators should continuously observe contractors in order to determine those that complete a well for a reasonable cost and do not waste material furnished by the operator. There have been many instances when mud and cement are stored in the open with the result in breakage and loss due to weather, and many times expensive mud is used as a paper weight when burning empty bags. The contractor's reputation for proper storage and use of operator's materials should be considered in conjunction with the bid price per foot. Most operators do not do so.

Regardless of the legal interpretation of a drilling contract, most contractors are going to drill as instructed by the operator's field personnel. This is as it should be, since daily operation is expensive and nothing is to be gained by shutting down while discussing differences between the contract and actual operations. However, the contractor should request the operator's representative to write instructions at variance to the contract, on the operator's drilling report and place his signature thereon. In this manner, the operator and contractor can later review any changes made that affect the contractor and make proper settlement. In addition, field personnel will be discouraged from making requests that are not required and do not facilitate operations. Furthermore, the operator's auditors will not question items at variance with the written contract.

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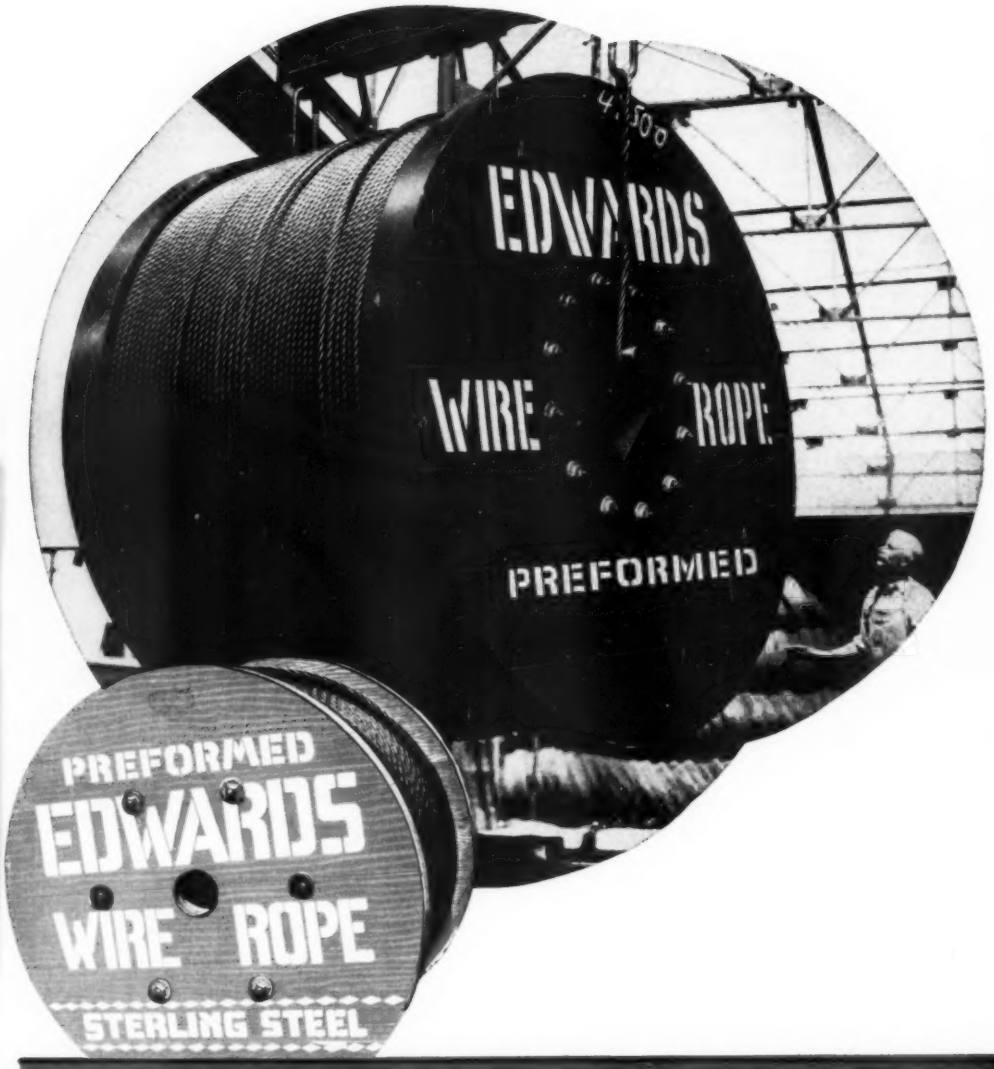

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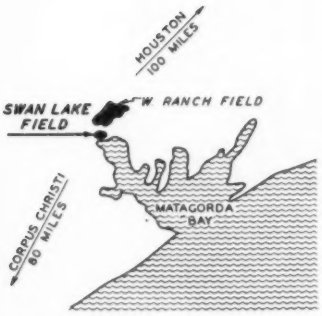

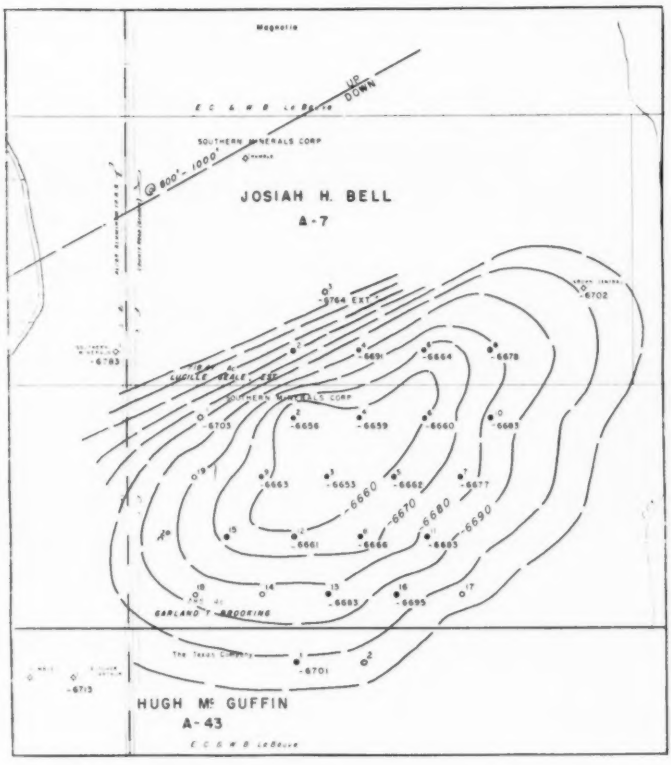

Above: Location map. Right: Structural map of Swan Lake field.

Swan Lake Still a Real Gulf Coast Hot Spot

SWAN LAKE field has been one of the major "hot spots" of South Texas since its discovery a little over a year ago. The field is in the southwest corner of Jackson County, 4 miles south of big West Ranch oil field.

Oil structure. — Swan Lake structurally is an elongated, anticlinal closure on the downthrown side of a down-to-the-southeast fault. The vertical displacement of the fault is 800 to 1,000 ft., generally northeast to southwest. Closure is effected by the reverse dip of the beds into the fault plane, and is about 200 ft. on the lower horizons.

At the 6,000-ft. horizon, the structure is rather ovate in outline and is of low relief. On the top of the 6,700-ft. sand, it is much sharper in outline and relief and the long axis has assumed a definite northeast to southwest direction. With depth, there is a progressive clockwise rotation of the longitudinal axis of the fold until the direction of the long axis is almost east and west at the deeper horizons.

Other than the larger controlling fault on the north side, there is no faulting in the field that affects the producing sands, and all present production is from sands of the Frio age.

Four oil reservoirs.—Swan Lake's four major oil reservoirs between 6,600-7,400 ft. have been developed with five completions in each reservoir and with a well density of one well per 57 reservoir acres.

The average figures for these four major reservoirs are: 285 acres, 12.31 ft. of effective sand, 33.5 per cent porosity, 22.5 per cent connate water, 3,800 md. permeability. The crude oil is saturated at original reservoir pressures, with the reservoir viscosity low. Solution gas-oil ratios average 800 cu. ft. per barrel, and bottom-hole pressures are normal.

Effective water drive is anticipated but the pressure production to date is not sufficient for accurate predictions on the drive mechanism.

Present indications are that in addition to the five oil and two gas sands above 7,400 ft., Swan Lake will have three oil sands and a gas sand below that depth.

Swan Lake crude is normal Gulf Coast, sweet and light naphthenic type, with an average gravity of 41° A.P.I. The crude is transported via Southern Pipe Line Corp. lines to a terminal 5 miles distant from where it moves by barge up the Intracoastal Canal to Texas City.

Drilling details. — The surface casing is set below 960 ft. and no intermediate string is necessary. Five-and-one-half-inch oil string is set on bottom and gun perforated for production after running of gamma ray-neutron log. Some of the deeper wells have been jet perforated for production. Both gel mud and lime-base mud are used. Mud weights of 10.6 lb. per gallon are adequate and water loss is maintained at 7-10 cc. below 6,000 ft.

Normal drilling time for a 7,400-ft. well is 21 days.

Development history.—The field's initial development program was completed by Southern Minerals Corp., Corpus Christi, during 1950, but exploration was renewed this spring when The Texas Co. found a deeper oil pay at 8,700 ft. Since then, Southern Minerals has completed one oiler in a new pay at 7,726 ft. and in mid-August was testing another oiler in the same sand. Two more tests were drilled to explore the possibilities below 7,400 ft. Another well was shut in after flowing gas and a spray of condensate at 8,418 ft. A sixth recovered pipe-line oil on drill-stem test at 8,233 ft.

The 1950 development at Swan Lake was in sands above 7,400 ft. Southern Minerals drilled 21 wells in the field, completing 20 as producers and 11 of these as duals. Spacing is on a 20-acre pattern.

Theoretical Aspects of Water Flooding

Here is an analysis of recovery methods by water flooding from both the operational and the physical-law standpoint

by John C. Calhoun, Jr.*

THE theory of water flooding might be approached from two basic viewpoints. From an operating standpoint it is desirable to know how production rates, final residuals, and water-oil ratios can be calculated beforehand from a knowledge of well-spacing injection program, formation characteristics, and fluid data. From the standpoint of physical laws it is desirable to know just how water moves oil through and from a rock. Both of these viewpoints can be considered theory, but the calculation of the desired operating quantities must be based upon some knowledge of oil displacement by water and the latter is, therefore, a more basic approach.

The question is often asked: "What formations can be water flooded?" Although the answer has an economic side also, the economics cannot be debated without a knowledge of the physical and chemical laws. The manner in which these laws combine under various natural and imposed circumstances to give different rate processes and residual conditions is the key to the success of a water-flooding venture.

One method to approach a problem of this nature is to assume an idealized picture of circumstances and by logic deduce the rate processes and residual conditions which result from the assumptions. For the problem at hand an idealized picture is rather difficultly achieved because there is no immediately handy means of describing the geometry of the space within which the flooding action occurs. Any visualization of the water-flooding process is stymied at this point or limited to a very ideal space geometry.

Another approach is to enumerate the variables which possibly enter into the displacement of oil by water, and to investigate analytically the expected dependency on those variables. Little has been done from an analytical standpoint but supposed factors have been investigated from an experimental standpoint and something is known about how many of these variable enter the problem.

The most important factors to be considered are probably (1) the wetting characteristics of the containing rock with respect to the contained fluids; (2) the geometry of the internal rock spaces within which the fluids are held and moved; (3) the physical character of the fluids themselves, primarily their relative viscosities but also the interfacial tension; (4) the initial saturation conditions with respect to the different fluids, and (5) the speed with which a displacing action occurs, measured in terms of velocity or pressure gradient.

The first three of these factors are

*Chief, division of petroleum and natural gas engineering, Pennsylvanian State College, State College, Pa. Presented at conference on Water Flooding, Department of Petroleum Engineering, Missouri School of Mines, Rolla, Mo.

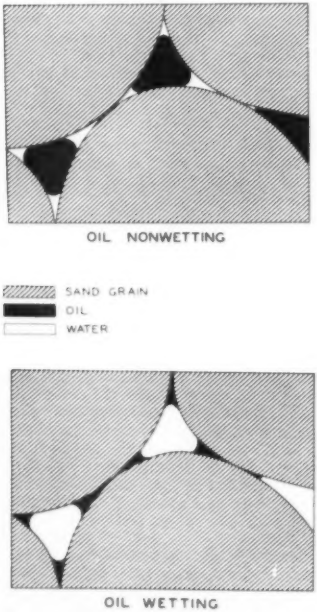

Fig. 1—Position occupied by oil or water as wetting fluid in a static system.

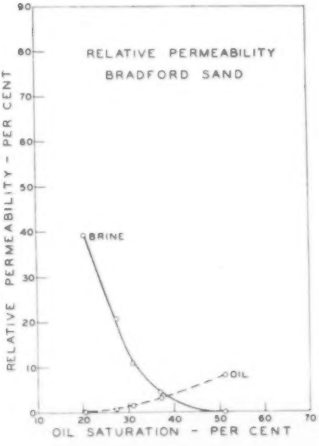

Fig. 2—(Ref. 3).

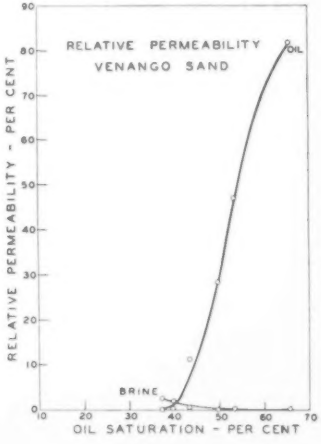

Fig. 3—(Ref. 3).

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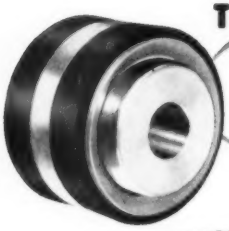

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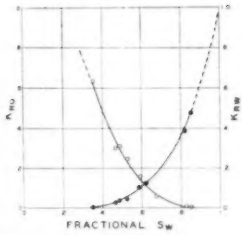

Fig. 5—Nelly Bly sand relative permeability curves. (Ref. 6).

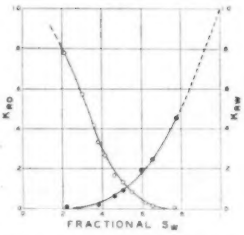

Fig. 6—Basal bromide relative permeability curves. (Ref. 6).

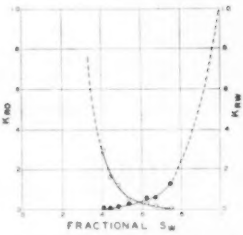

Fig. 7—Wasson lime relative permeability curves. (Ref. 6).

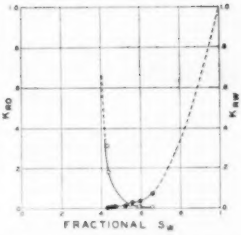

Fig. 8—McClosky lime relative permeability curves. (Ref. 6).

fixed in a given reservoir. There is some possibility of making a change in any of them, however, through operating practices. The initial saturants prior to flooding may also be controlled to a degree. The speed of flooding or pressure gradient may also be controlled but only within limits. All of the factors are probably interdependent in the action which they may have on the flooding mechanism.

Wetting Fluid

Perhaps the most important of these items is the wetting character of the rock with respect to the contained fluids. A change in this factor can completely reverse the roles played by water and oil as they move through the pores of the rock. It is generally now recognized[1,2] that under static displacement conditions the wetting phase occupies those spaces next to the surface of the rock and in the fine interstices. Thus, whether oil or water be the wetting fluid makes a fundamental difference in the position occupied within the rock by the residual oil. These reverse positions are shown in Fig. 1 as they would appear in a static system.

Of course, there is the question of whether the static wetting situation holds true under dynamic conditions. There is some evidence that it does. This evidence comes principally from relative-permeability tests, but also from displacement studies.

Relative permeability curves have definite character due to wettability as shown by different authors.[3,4] These wetting characteristics are in agreement with the static capillary pressure characteristics on the same type material. Fig. 2 shows a relative permeability curve for an oil-wet system, and Fig. 3 for a water-wet system. That these systems are oil or water wet is attested to by capillary properties. The principal difference in these curves is the manner in which the wetting and nonwetting phase permeabilities increase with their respective saturations. However, it has also been demonstrated in at least one case[4] that a time lag occurs in establishing wetting equilibrium. There remains, therefore, for some systems the question of what the wetting character may be at the time and place where the displacement occurs, and the rapidity with which the wettability can change with respect to the speed of the displacement process.

It has also been demonstrated in displacement experiments that the wetting character of a system has

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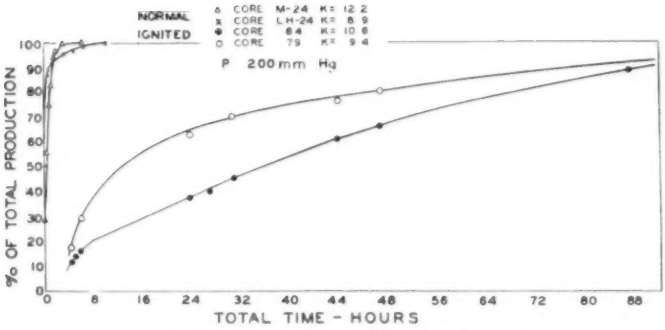

Fig. 4—Rate of brine production with crude-oil flood. (Ref. 8).

some bearing on its production history.[8,10] Fig. 4 shows the basically different producing histories by flood pot tests in two systems where the cores were originally of the same oil-wet material, but one set had been acid treated and fired to make it water wet. The pore geometries of these cores are similar and the manner of making the flood pot tests was not changed.

Wetting characteristics are felt to be one of the most important factors to be considered in water-flooding theory. A change in wetting character involves a qualitative change in the position of fluids in the flooding system. Therefore, the importance of other factors will depend upon the wetting and a given variable may have an opposite effect if the wetting conditions are reversed.

Pore Geometry

Whereas the wetting character gives a qualitative idea of the nature of residual oil, the pore geometry produces a quantitative measure. This is probably the most important factor governing the amount of residual oil, but unfortunately little is known except in a general way about the nature of pore geometry. Considerable research effort is pointed in this direction, however.

Capillary-pressure curves and relative-permeability curves presently give the best indications of the role of pore geometry. Figs. 5, 6, 7, and 8 show relative permeability curves on rocks of four different types. They are illustrative of the wide variation in flow characteristics to be expected. All four sets of curves were taken with the same fluids. All of these illustrate water-wet systems. The pore geometries as indicated by relative-permeability curves cannot be compared unless the wettabilities are the same.

It cannot be said explicitly from these curves just what the internal space geometry is in each rock. It can be said, however, that the differences in connate-water values, in oil residuals, and in rate of increase of water-oil ratio are due to the four different pore arrangements possessed by these rocks. The variation in water-oil ratio increase is shown in Fig. 9.

The illustrations shown here are for different formations. However, even within a given formation variations due to pore geometry are known to exist. Recognition of pore-geometry variations has been shown through pore-radius studies and permeability calculations based upon capillary-pressure curves.[11,12] This approach has brought about use of a factor called a "tortuosity" or "textural" constant to evaluate the quantitative expression between pore geometry and other core properties.

These advances are toward a better evaluation of the flooding process, because any comparison of flood

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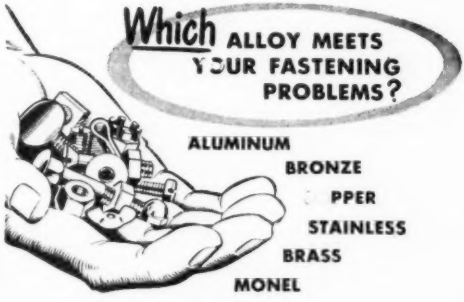

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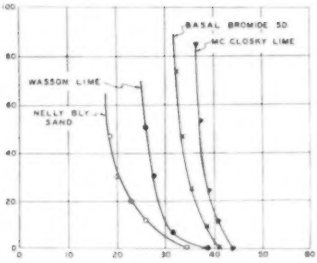

Fig. 9—Residual-oil saturation vs. water-oil ratio. (Ref. 27).

behavior between two systems must take this evaluation into account.

Fluid Viscosities

The possible role of fluid viscosities was early considered in relative-permeability work.[13 14 15] It has generally been demonstrated that viscosity changes of considerable magnitude do not change the relative-permeability curve. Moreover, the same residual conditions of saturations are apparently reached with fluids having widely different viscosities. Figs. 10 and 11 illustrate published relative-permeability tests with viscosity as a variable.

In this discussion the relative-permeability curve has been introduced to show evidence of factors that are known to produce changes in the behavior of fluid-rock systems. The argument has been that these factors must be important in displacement because they show up in relative-permeability variations. But does the inverse hold true? If a given variable has no effect on the relative-permeability curve does that mean it has no effect in the displacement process?

The relative-permeability measurement is made under steady-state conditions, whereas flooding process is

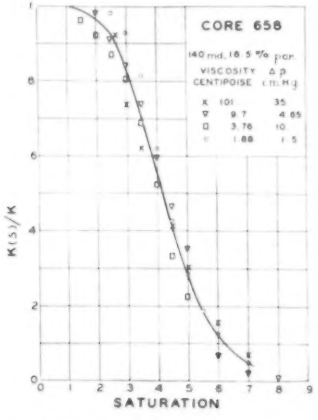

Fig. 10—Relative permeability of a core vs. saturation. (Ref. 14).

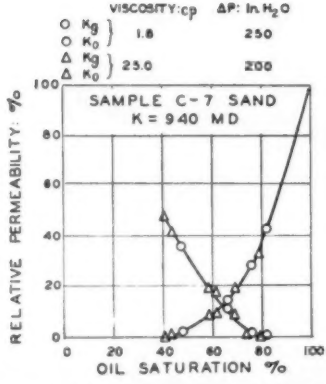

Fig. 11—Relative permeability with viscosity as variable. (Ref. 15).

one of unsteady state. Not all unsteady-state processes reach the same end conditions as given by a steady-state system at equilibrium. Often the end point depends on the manner in which the system approaches the end point.

There are available some displacement data showing the effect of viscosity.[16] This particular set of experiments, illustrated in Fig. 12, indicated that the residual conditions would be independent of oil viscosity provided each test had been run for a sufficient length of time. On this graph the residual at water breakthrough, at one pore volume throughput and at 1.95 volumes throughput are shown. All approach the same residual value but at slower rates as the oil viscosity increases. It must be emphasized, however, that this result was for a system with a given wettability and pore geometry and it is entirely possible that systems with different pore geometries or different wettabilities might show a viscosity effect.

Although the residual conditions remain constant the rate processes are markedly affected by a change in fluid viscosities. This has come to be recognized in flooding in the relative importance of primary and secondary phases of production, or in the extent of the water-oil-ratio increase. Fig. 13 shows the nature of the change in production before and after water breakthrough for the same displacement experiments previously quoted

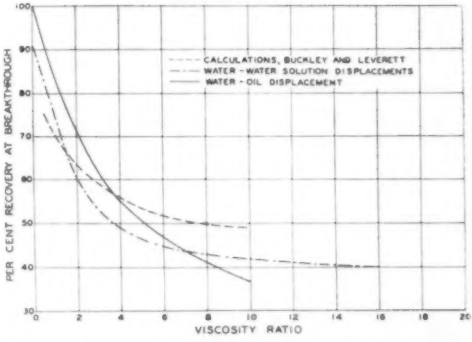
CALCULATIONS, BUCKLEY AND LEVERETT
WATER - WATER SOLUTION DISPLACEMENTS
WATER - OIL DISPLACEMENT
PER CENT RECOVERY AT BREAKTHROUGH
VISCOSITY RATIO

Fig. 13—Change in production before and after water breakthrough. (Ref. 16).

and for calculations of Buckley and Leverett.[9]

Water-Oil Ratio

It can be inferred from the constancy of relative permeability with oil viscosity that the water-oil ratio would be affected. The ratio of producing rates is proportional to the product of the relative permeability ratio and the inverse viscosity ratio, thus

$$\text{producing water-oil ratio} \propto \frac{k_w}{k_o} \frac{\mu_o}{\mu_w}$$

As the ratio μ_o/μ_w increases for a given relative-permeability ratio the producing ratio becomes larger, a matter of economic significance.

Velocity of Flooding

Another factor which has received much discussion and experimental attention is the pressure gradient of displacement or velocity of flooding. Again the relative-permeability curve may be referred to first. Leverett[9] called attention to an effect with pressure, but later felt it to be due to experimental techniques.[18] Krutter[14] saw no effect with pressure. Fig. 14 is from his work. More recently an effect

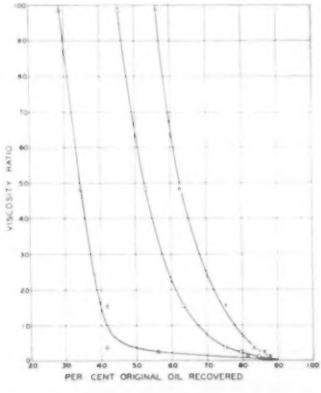

Fig. 12—Viscosity ratio to per cent of original oil recovered. (Ref. 16).

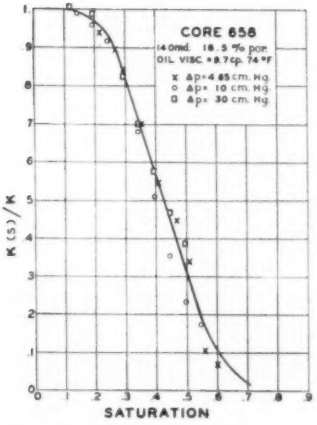

Fig. 14—Relative permeability vs. saturation. (Ref. 14).

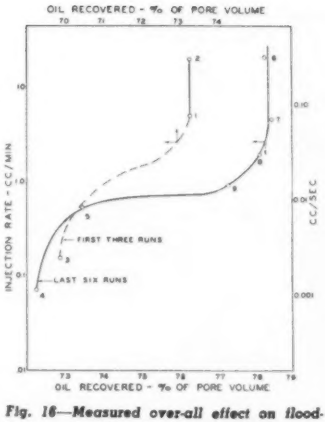

Fig. 16—Measured over-all effect on flooding as a function of velocity. (Ref. 5).

flood, the second being gas for oil in a water-wet system under water flood.

In order to tie all of these variables down to some common framework it would be desirable to have an appreciation of the microscopic mechanism by which water displaces oil through a porous medium. The work currently reported toward evaluating this mechanism visually[8,9] appears to point toward a microscopically heterogeneous flood advance even in those ideal systems studied wherein the macroscopic advance appears to be an exact linear motion. Furthermore these investigations indicate that displacement is a selective process among channels rather than selective within channels. This type of work, still in early stages of development, will undoubtedly go a long way toward forming the necessary background toward ultimately laying a sound

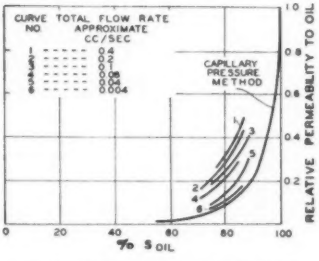

Fig. 15—Effects of flow rate. (Ref. 18).

observations led the experimenters to note that this effect was a result of the particular length of system chosen for experimentation and that a different curve would result from a shorter system. In fact, the mere choice of a long core for displacement experiments does not free the test from capillary boundary effects, chief source of erroneous pressure-gradient effects. Fig. 17 illustrates one group of tests in which final residual oil is independent of gradient.

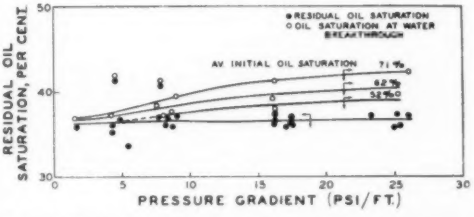

Fig. 17—Residual-oil saturation and saturation at breakthrough vs. pressure gradient, after Sheppard. (Ref. 28).

with pressure gradient has again been noted.[18,19,3] Fig. 15 illustrates such an effect. However, it can be shown that this effect is due to experimental technique.[18]

At the present it is generally conceded that the relative permeability is independent of pressure gradient. Whether this can be taken as proof that displacement is independent of pressure gradient poses the same basic arguments that apply to viscosity effects concerning the application of relative permeability data to displacement.

Experiments on displacement[20,21,1,22,19,23] have been reported to show almost every conceivably possible change with pressure gradient. However, in few instances have there been comparisons possible under circumstances controlled enough to warrant a definite conclusion. Further, there is no particular reason to suspect that the effect of this factor should be the same in all systems or under all ranges of gradients.

One recent report on displacement[1] definitely illustrates that misleading results can be reported, even though experimental conditions have been apparently well controlled. Fig. 16 shows the measured over-all effect on flooding as a function of velocity from this reference. However, visual

The answer to the effect of pressure gradients in flooding depends upon a complete understanding of the interdependence of variables during displacement. Since this obviously may be entirely different for systems with different wettabilities and pore geometries it follows that there is at present no available definite answer on the question of pressure gradients.

The variables entering into flooding have not been considered entirely until one considers the initial saturants prior to flooding. The relative amounts of gas, water, and oil present within the pore channels will govern the subsequent movement of displaced and displacing fluids and the residual end point obtained. Three-phase flow data are available only on water-wet systems.[17] These data show a change both in end conditions and ratios with the change in relative amounts of the nonwetting phases.

Some data have been reported on flooding experiments[19,20,21] wherein one nonwetting phase has been substituted for another nonwetting phase. Figs. 18 and 19 illustrate this type of substitution, the first being gas for water in an oil-wet system under oil

theory which includes all the variables earlier enumerated.

Field Processes

The second broad phase of waterflooding theory is that which involves the application of basic physical data to the prediction and control of field processes. The chief drawback in this respect is a tendency to transform results of core experiments directly to field behavior without taking into account any limits of the experimental systems involved. This has led to many misconceptions.

To illustrate from a different branch

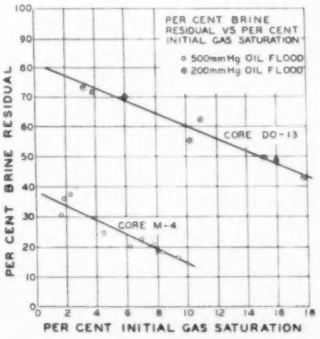
PER CENT BRINE RESIDUAL VS PER CENT INITIAL GAS SATURATION
500mm Hg OIL FLOOD
200mm Hg OIL FLOOD
CORE DO-13
CORE M-4
PER CENT BRINE RESIDUAL
PER CENT INITIAL GAS SATURATION

Fig. 18—(Ref. 10).

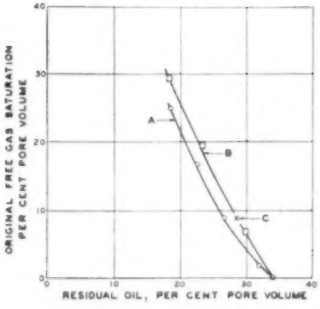

Fig. 19—Relation between free-gas saturation and residual-oil saturation at 100-to-1 oil ratio. (A) Gas trapped by oil flood only; (B) gas trapped by oil flood and expanded by pressure reduction; (Point C) gas established by internal drive. (Ref. 23).

of the petroleum industry, consider the refinery engineer, who in order to operate a fractionating tower does not run a batch distillation in the laboratory but instead, determines the equilibrium constants which apply to the components of the system under study. By utilizing those equilibrium data in the proper analytical fashion he predicts and controls the performance of the tower.

In water flooding we are just beginning to recognize the need for the basic differential quantities analogous to equilibrium constants. Once these have been determined by proper laboratory means the application to a specific field instance will be a matter of integration within the proper physical limits.

There has been advanced for some time one theory of flooding, the basis of which is the relative-permeability property of the system considered.[9] This method, in effect, assumes the steady-state measurement as representative of differential flow. The details of making a calculation by this method will not be repeated here. The method gives results which, at least qualitatively, agree with experimental results. The calculations show the flooding process in two stages, a primary and secondary phase and a variation with viscosity of the oil phase.[9 10] In one instance the calculations by this method agree with the observed variation even in a three-phase system.[26]

In using this method of approach, care must be taken that the capillary-pressure data and relative-permeability data used are correctly either imbibition or drainage curves.[6]

It cannot be said that this particular approach has been shown to give a complete calculated history. There are some reasons to believe it might not always apply to all displacement situations.[5] This again depends upon an understanding of the microscopic mechanism of displacement. However, the method has become a useful tool in evaluating possible flood performance. One approach has shown this method on several types of formations.[27] Fig. 20 illustrates the results therefrom. Until a better procedure is advanced this method of calculating flood performance has considerable merit in predicting both end points and rate changes. Achieving this result, however, still produces only the behavior in a homogeneous system.

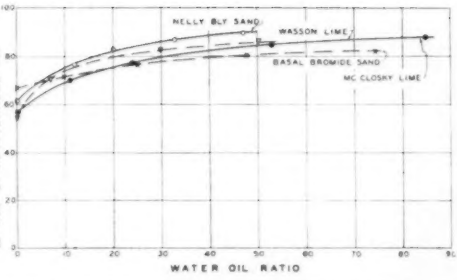

Fig. 20—Per cent recovery of recoverable oil vs. water-oil ratio. (Ref. 27).

One of the largest problems to be considered in applying any theory to field conditions is the heterogeneity of the petroleum reservoir. This heterogeneity exists in several respects.

First is the heterogeneity of the rock system itself. This has been dealt with partially by assuming the reservoir to be made up of independently acting horizontal layers either finite in number or continuously varying. It has been suggested that a heterogeneity coefficient can be established to enable correlation of performance.

Second is the heterogeneity of fluid content of the reservoir rock to be flooded. This problem has not been approached except through the taking of averages.

Third is the heterogeneity of geometry resulting from the manner in which wells are spaced and completed within the reservoir. Each of these types of heterogeneity must be included in the application of basic theory to a flood operation.

In applying any theory to a flood operation it is possible that pressure gradients and viscosity ratios may have an effect due to the heterogeneity conditions even though they may have no effect in homogeneous strata. None of these heterogeneities have been investigated in any detail. In fact, their investigation in full must be dependent upon the attainment of an understanding of the water-displacement process just reviewed.

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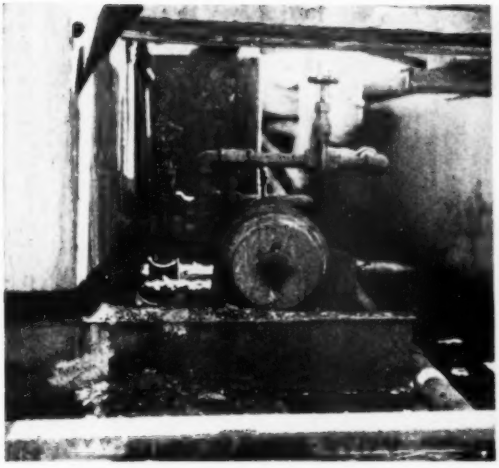
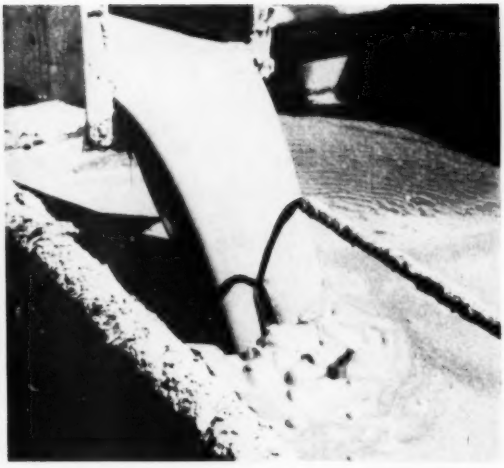


This centrifugal pump operates in double-duty service.



Additive is fed directly into mud stream entering tank.

Kellogg Develops Novel Mud-Mixing Idea

Solution mixed into mud stream as it flows from flume into settling tank

AN idea by K. L. Kellogg & Sons, drilling contractors in the Los Angeles Basin and elsewhere, has been developed into a method of compounding additives and mixing the solution into the mud stream as it flows from the flume into the sand settling tank.

Mixing the various chemicals for mud control is done in a rectangular steel tank mounted on a structural steel base, which unit may be moved intact from one well to another. The base extends beyond the tank to supply a foundation for a small electric-driven centrifugal pump. The small pump is employed to recirculate the solution until a thorough compounding is obtained. A manifold in the discharge piping from the pump is built to return the solution back to the tank until the desired mix is obtained. Closing off the return line to the tank, and opening a gate valve on another diverts the solution into a transfer line that leads directly into the overflow from the end of the mud flume leading from the shakers.

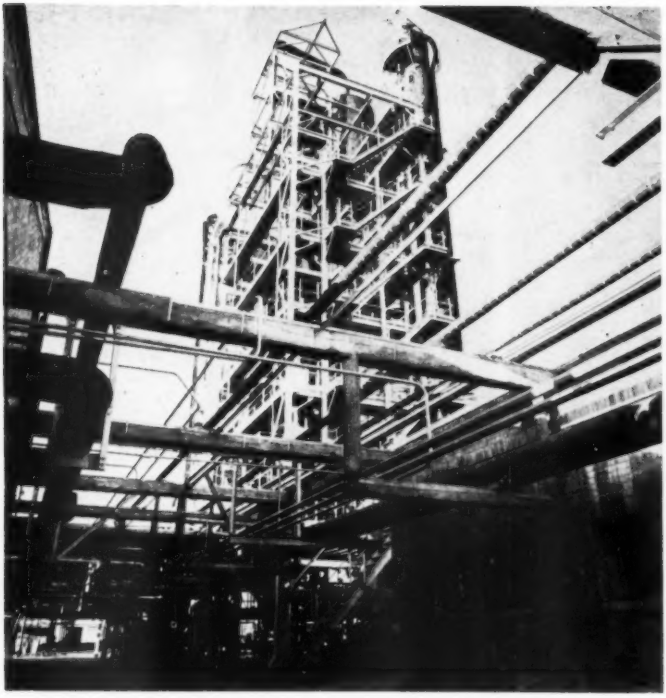
Introducing the solution into the mud stream at a point above the fluid level in the sand-settling tank provides adequate time for the turbulence of the flow to thoroughly mix the two streams of fluid. Riffles and mechanical mixers are not necessary since tests at the mud-pump suction indicate that the circulation is uniform and consistently homogeneous.

Another idea put into practical application by Kellogg is the method of laying mud-pump suction piping to the mud tank. Instead of using screwed or bolted flanges as an outlet for the tank to connect the suction lines, identical goosenecks are provided with throats deep enough to enter any mud tank over the side rail.

Suction end of the gooseneck is adjusted so the travel of the mud from the tank to the pump sweeps the floor of the pit, so that separation does not occur between heavy and light components of the drilling fluid.

A certain amount of rigging time is saved with this type of suction as the mud tank can be set down anywhere within range of the goosenecks. Strains on the fittings are eliminated since there is no direct contact between the mud-pump suction lines and the body of the tank itself.

Offset bends simplify installation and eliminate tank flanges.



New topping plant at Grangemouth, Scotland, refinery.

Distillation Unit on Stream

Anglo-Iranian affiliate completes installation of new facilities at its Grangemouth refinery

by V. S. Swaminathan*

AN important event in Britain's oil-refining expansion program occurred when new crude-oil-distillation facilities at Grangemouth in Scotland, owned by Scottish Oils, Ltd., an affiliate of the Anglo-Iranian Group, were placed on stream.

The original refinery, designed for a throughput capacity of 360 000 long tons a year, started operations in 1924. A limited range of petroleum products—gasoline, kerosine and fuel oil—was originally manufactured at Grangemouth. Equipment in the initial plant consisted of a battery of five shell stills, a steam shell-still redistillation unit for the separation of kerosine and gasoline. Treating equipment included agitated washers for gasoline and a bauxite unit for the final sweetening of kerosine. Auxiliary equipment generally consisted of steam boilers, pump houses, workshops, and offices. One jetty situated within the Grangemouth dock area handled incoming and outgoing shipments, and a rack for the filling of tank cars made up the plant's general shipping facilities.

Twenty-five years ago the Grangemouth refinery was operated and maintained by about 120 workers, and the night shift numbered a mere 10 under the control of a shift foreman.

The first substantial expansion program for Grangemouth was inaugurated in 1929. Two continuous crackers with stabilizing equipment, an Edeleneau SO_2 plant, a Holly Mott treater, and ethyl blending equipment were installed under the program. Also additions were made to the power plant, workshops and jetties.

Although crude-oil input remained at the original rate the range of products was expanded to include premium and regular gasolines, two grades of kerosine, tractor vaporizing oil, white spirit, rubber solvent, gas oil, and various grades of fuel oil.

The outbreak of World War II meant the virtual cessation of crude-oil supplies necessary for operating this refinery. Early in 1940 it was shut down, and placed on standby status.

Since postwar demands called for quantity above all else the cracking units at Grangemouth have been converted to distillation of crude oil, and other equipment adapted to give maximum output. By such expedients the throughput was stepped up to 670,000 long tons per annum.

First Stage of Program

The current expansion program is being executed in two stages. The first part, comprising the installation of a modern distillation unit, with stabilizing equipment and a comprehensive range of treating plants for refining the various fractions, was completed early in March of this year. Forming an integral part of the first stage is the new plant of British Petroleum Chemicals, Ltd., a joint Anglo-Iranian and Distillers venture, which will produce a wide range of chemicals from a feed stock supplied by the enlarged refinery. This petrochemical concern will produce ethyl and isopropyl alcohol. These products will play an important part in relieving the shortage of molasses, the main source of raw material for alcohol in Britain. It will also provide other products for the manufacture of pharmaceuticals, dyestuffs, and textiles.

A new steam-generating and an electric power plant of 20,000 kw have also been completed. These, coupled with water pumping, cooling, and compressed-air facilities, are situated in a service area lying between the refinery and the chemical plant.

Anglo-Iranian Oil Co.'s expansion program in Scotland alone involves an outlay of £17,500,000. In addition to the reconstruction and extension of the Grangemouth refinery, a crude-oil pipe line is being built. Monsanto Chemicals, located on an adjacent site is another important plant for the production of petrochemicals, in particular monomeric styrene, an essential raw material in the plastics industry.

Second Stage

Stage two, now under development planned for completion by the middle of 1952, provides for the production of premium-grade gasoline and special products. This phase of the program includes a modern cat cracker, a vacuum distillation feed-preparation unit, and a catalytic polymerization plant. In addition, there will be a treating plant to handle products from the cat cracker, and a small distillation and treating unit for white spirit and other specialties.

Two new jetties, extra storage tanks, pipe lines and pumps, and enlarged tank truck and tank car filling sheds form other integral parts of the second stage of expansion.

*5 Fielding Road, Bedford Park, London, W. 4, England.

High efficiency in operation of the crude flash tower for this thermal cracking unit is obtained with a differential-pressure recorder. Two other processes at the Texas City refinery of Pan American Refining Corp. are similarly equipped.

Differential-Pressure Instruments for

Improving Refinery Processing

by William Kaplan and D. J. Bellman

Pan American Refining frequently augments customary instrumentation at its Texas City plant by installation of differential-pressure indicators and recorders for improved operation of bubble-cap towers.

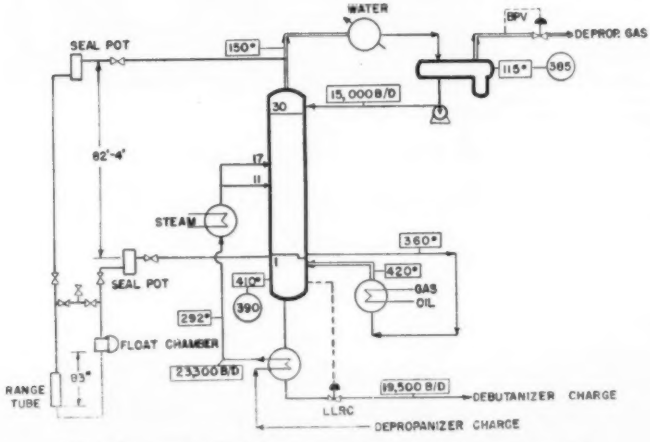


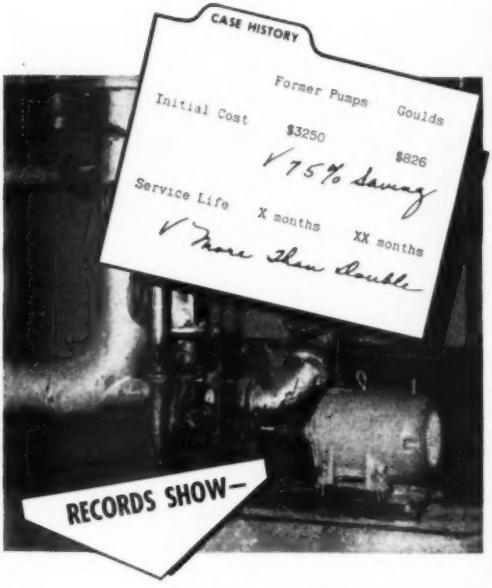
Fig. 1—Instrumentation of depropanizer tower at catalytic cracking unit.

IN the normal operation of any modern petroleum refinery, certain problems are encountered in the operation of bubble-cap towers. Frequently, it is found that fractionation is apparently impaired, and separation between key components is not as good as it should be. When this occurs, a systematic check is required to determine the reason for the poor fractionation. Is the reflux ratio normal? Is the reboiler duty normal? Has any change occurred in the feed preheat temperature? Has there been a change in feed composition? Is the tower dirty? Have any of the bubble caps been blown off the trays? Is the tower flooded?

To answer these questions, meters are checked, tests are conducted, calculations are made, and some fancy guesswork is finally resorted to.

At the Texas City refinery of Pan American Refining Corp., customary instrumentation has been frequently augmented by the installation of differential-pressure indicators and recorders for improved operation of bubble-cap towers.

Earliest application of these instruments was at the fluid catalytic cracking unit in 1946. At this unit, differential-pressure recorders, installed across three sections of the main fractionator, established with certainty that fractionator-tower flooding started in the lower baffle section of the tower, rather than the bubble-tray section. This made it possible to apply successful corrective measures for increasing capacity. Later, a differential-pressure recorder was installed across a section of the high-pressure bubble tower at one of the



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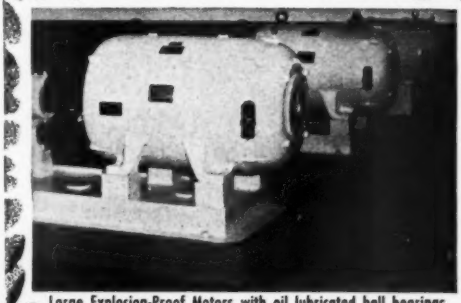

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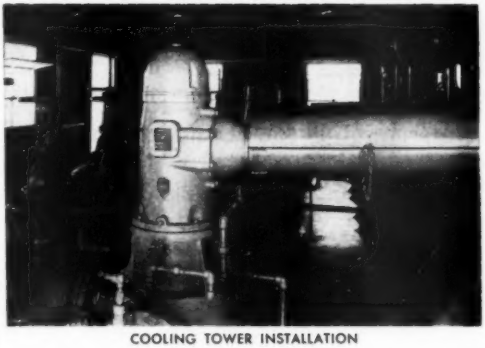

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WILLIAM KAPLAN

D. J. BELLMAN

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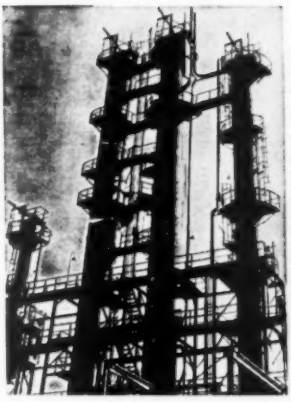

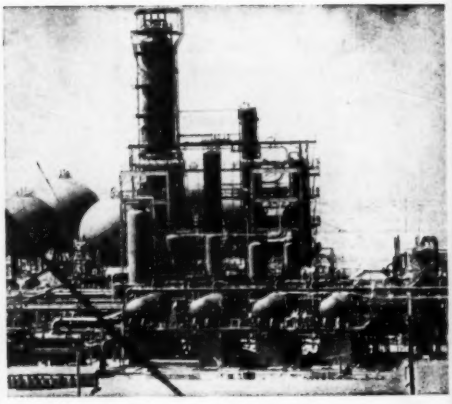

Differential-pressure instrumentation provides improved operation of fractionator, left, and alkylation plant, right.

cracking units for permitting operation at peak loading, short of flooding, an application which is described in this article. These installations have proved so satisfactory that other refinery units have been equipped with similar instruments.

Installations at (1) the catalytic cracking unit depropanizer tower, (2) the crude flash tower at a thermal cracking unit, and (3) the hydrogen sulfide absorber at the polymerization unit are also covered here. These applications have been successful in the elimination of tower flooding, for the location and detection of plugging, for control at maximum charge rate without priming, and for prevention of absorber-liquid carryover.

Depropanizer Tower at Catalytic Cracking Unit

One of the more recent examples of the use of a differential-pressure recorder for improving refinery operations occurred at the catalytic cracking unit. At this unit a depropanizer tower is operated to separate between propane and butane. Fig. 1 shows the instrumentation utilized for tower operation, as well as recent typical tower operating conditions. As shown, the overhead reflux condenser operates as a partial condenser, with level in the reflux drum being maintained by manually adjusting the volume of cooling water through the overhead condenser. A back-pressure valve on the depropanizer reflux drum gas stream is used to maintain tower pressure.

Reboiler outlet temperature is established by a temperature controller which resets the flow of gas oil to the reboiler, and the feed preheat temperature is maintained by a steam preheat exchanger. Bottoms from the depropanizer pass to a debutanizer where butanes are recovered as an overhead product. Also shown in Fig. 1 is the diagrammatic arrangement for the differential-pressure recorder which was recently installed across the tower.

Prior to September 1950, when the unit was shut down for making changes to increase capacity, loadings were never great enough to cause difficulty in attaining the necessary propane-butane separation. Although tower fractionation was generally satisfactory, there were several short periods when poor separation was noted, and for which there was no apparent explanation at the time.

After a unit revamp (in September 1950) the charge rate to the depropanizer tower was increased by 25 per cent and the desired 3.0-4.0 mol per cent maximum propane in the butane stream was not attained with previously established operating conditions without excessive butane

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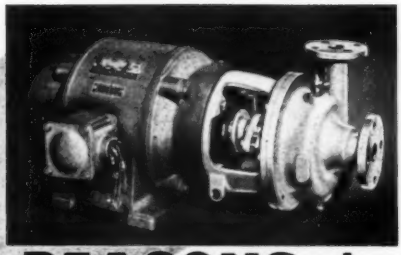
(a) Increased feed rate; operation just below flooding.
(b) Sharper split between desired overhead and bottoms.
(c) Reduction of overhead entrainment.

☐ 2. The differential pressure recorder on the depropanizer also helped to improve operation by:

(a) Aiding in relocation of feed tray to provide better fractionation.
(b) Indicating increased feed preheat to prevent flooding in the stripping section.

☐ 3. A differential pressure recorder on a hydrogen sulfide absorber enabled:

(a) The determination of foaming conditions and application of measures to prevent loss of amine solution.
(b) The consistent production of polymer gasoline of low sulfur content.
(c) The determination of plugging on any given tray in the absorber.



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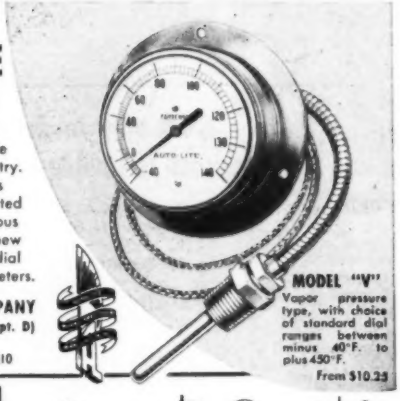

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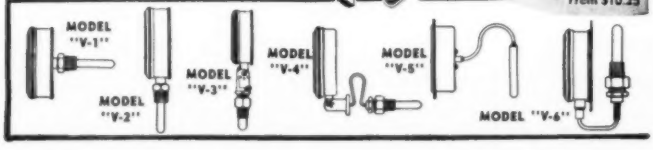

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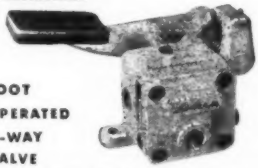

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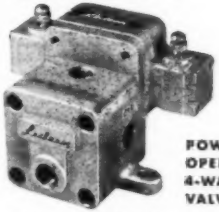

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losses in the depropanizer gas. A comparison of operating conditions and pertinent product analyses before and after the revamp is given in Table 1.

TABLE 1

	Feed rate (B/SD)	Reflux rate (B/SD)	Feed temp. (°F.)	Tower top temp. (°F.)	Reboiler outlet temp. (°F.)	Tower press. (psig.)	C_4 in deprop. gas (mol %)	C_3 in butane (mol %)
Before revamp	19,900	13,500	285	144	415	382	4.4	3.9
After revamp	22,900	16,100	280	153	421	393	7.2	4.9

In an attempt to improve fractionation, the reflux rate was increased to 17,250 bbl. per stream day and the reboiler outlet was increased to 426° F. These operating conditions did not improve fractionation and it was suspected that the tower stripping section was flooding. Using calibrated test pressure gages, pressure measurements were made at the top and bottom of the tower to determine the pressure drop. The measured drop was about 11 psi.; consequently the reflux rate was lowered until flooding was terminated. Table 2 summarizes the differences in tower operation and loadings between flooded and unflooded conditions.

a differential pressure recorder across the tower would offer a means for easily recognizing initial flooding conditions. In the installation of this instrument, to compensate for the 82-ft. 4-in. seal liquid head between the vapor-line seal pot and the range tube, an 83-in. mercury leg was installed between the float chamber and the range tube of the recorder.

From data obtained at the unflooded tower operating conditions, calculations indicated that the optimum feed plate was near the seventeenth tray instead of the eleventh tray from the bottom which was previously used for this purpose. Since tower flooding was controlled by flooding of the bottom tray of the tower stripping section, the feed preheat was increased to the maximum temperature of 298° F. (limited by steam flow to the preheat exchanger) to obtain maximum fractionation.

After installation of the differential pressure recorder, feed preheat was increased to a maximum value, the feed nozzle was changed from the eleventh to seventeenth tray from the bottom, and reboiler outlet temperature was set at 420° F. The reflux rate was then increased until flooding was indicated by a significant increase in the pressure differential across the tower. The rate was then reduced slightly to unflooded conditions.

Definite signs of flooding occurred with the above operating conditions when the overhead reflux rate reached 16,000 bbl. per stream day; consequently, the reflux rate was established at 15,000 bbl. per stream day to allow for small variations in normal operation. Fig. 2 illustrates an example of depropanizer tower flooding as indicated by the differential pressure recorder. From the maximum differential shown, it is estimated that the lower six trays were flooded before the corrective measures reversed the flooding.

Table 3 shows typical data obtained since installation of the differential-pressure recorder.

Since the tower is consistently operated very near the flood point, the differential-pressure recorder has been followed closely to show when threshold flooding was occurring. The instrument has proved very satisfactory for this purpose and extended periods of towers flooding have been very rare since the installation of this instrument.

TABLE 2

Condition	Feed rate (B/SD)	C_4 in deprop. gas (mol %)	C_3 in butane (mol %)	Ovh'd. reflux rate (B/SD)	Reboiler duty, M. B.t.u./hr.	Tower press. diff. (psi.)	Bottom tray loading* — Inches of liq. h_{ow}	h_{rc}	h_d	Backup % tray spacing
Flooded	23,400	18.0	4.4	17,250	33.4	11	3.06	1.71	0.48	38.6
Unflooded	24,400	8.0	6.4	9,250	29.6	4	2.77	1.18	0.38	32.0

Where: h_{ow} = head of liquid over the weir, h_{rc} = friction head due to flow of vapor through risers and caps, h_d = friction head due to liquid flow through downspouts.

"Process Design Procedure for Multicomponent Fractionators," C. G. Kirkbride, Petroleum Refiner, Vol. 23, pp. 321-36 (1944).

It was realized that to attain the desired fractionation, it would be necessary to maintain consistently tower operating conditions at loadings very near the flood point. Installation of

TABLE 3

Charge rate (B/SD)	Reflux rate (B/SD)	Feed temp. (°F.)	Tower top temp. (°F.)	Reflux drum temp. (°F.)	Reboiler outlet temp. (°F.)	Tower press. (psig.)	C_4 in deprop. gas (mol %)	C_3 in butane (mol %)
24,290	15,000	290	151	124	417	390	4.7	2.8

Fig. 3—Schematic arrangement of high-pressure bubble tower, thermal cracking unit.

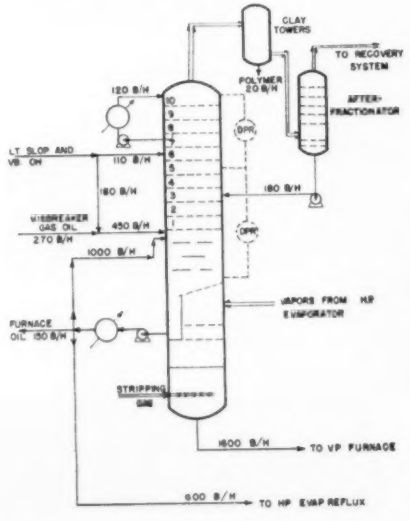
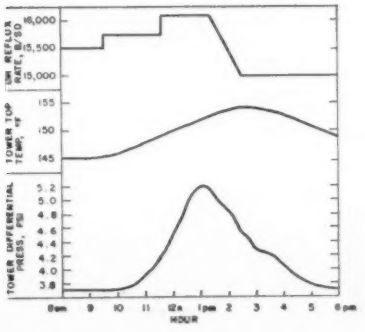


Fig. 2—Example of depropanizer tower flooding indicated by recorder. Feed temperature, 292° F. Tower-bottom pressure, 390 psig.



A high-pressure bubble tower is used to fractionate between gasoline and recycle gas oil, the latter constituting the bottoms from the bubble tower which is cracked in the vapor-phase furnace and soaking drum. The bubble-tower gasoline overhead is clay treated in the vapor state, with the gasoline end point being controlled in the afterfractionator tower. Afterfractionator bottoms are recycled to the bubble tower.

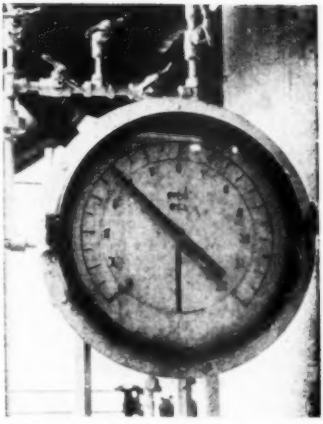
As shown in Fig. 3, there are 10 bubble trays in the upper section of the 11-foot-diameter bubble tower, at 36-in. tray spacing. Three baffles are located below the bubble trays at 30-in.

spacing in lower part of the tower. The trough shown in the diagram is used to direct liquid into the intermediate trapout boot. The tower pressure is maintained at about 180 psig., with top and bottom temperatures of 480° and 650° F., respectively.

Feed stock to the high-pressure bubble tower of the vapor-phase system consists of visbreaker gas oil, visbreaker overhead, and light slop. The latter two stocks contain an appreciable amount of gasoline, and feeding on the sixth tray is considered advisable in order to strip out as much of the gasoline as possible. With poor stripping, excessive naphtha is retained in the vapor-phase furnace charge from the bottom of the tower with a corresponding decrease in cracking capacity.

When attempts are made to feed all of the visbreaker gasoline and light slop on the sixth tray, indications of flooding or entrainment in the high-pressure bubble tower have been observed. Usually a sudden increase in clay polymer production was an indication of flooding or entrainment and these streams were either reduced or fed to the baffle section of the tower.

Calculations of "backup" in various sections of the tower did not indicate that the tower capacity was taxed to the extent that there would be flooding, so a differential-pressure recorder was installed in order to determine whether there was actually any flooding. The differential-pressure recorder was installed across the entire bubble-tray section and the three baffles, and occasional large increases in the pressure drop proved that the tower was actually flooded.



Differential pressure indicator on absorber tower.

In order to determine the approximate location at which flooding commenced, an additional differential-pressure recorder was installed so that with both instruments the pressure drop could be measured separately across the upper five trays, and across the lower five trays and three baffles. Typical data taken when flooding started are given in Table 4. These data show that flooding started either in the lower five trays or in the baffle section.

TABLE 4

Time	Press. drop (in. water) Across lower 5 trays and 3 baffles	Across upper 5 trays
11:00 a.m.	38	10
11:30 a.m.	36	10
12:00 noon	40	12
12:30 p.m.	46	10
1:00 p.m.	64	11
1:30 p.m.	67	16
2:00 p.m.	68	30
2:30 p.m.	68	58

Installation of the differential-pressure recorder has made possible operation of the tower at high feed rates and still have a means of correcting any flooding before there is a large decrease in fractionating efficiency. The light slop rate can be kept at a maximum, and fractionation can be maintained to minimize the naphtha content of the vapor-phase charge.

Thermal Cracking Unit Crude Flash Tower

Until a year ago, the crude charged to one of the cracking units had been a naphthenic blend containing relatively small amounts of gasoline and kerosine boiling-range components.

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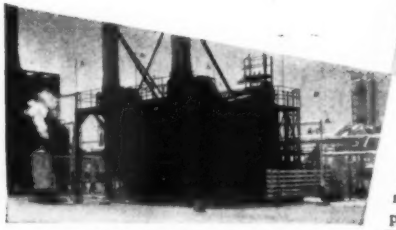
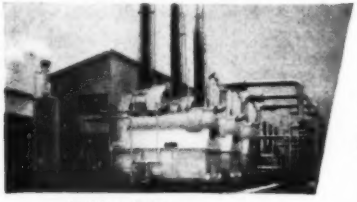


Central Texas Natural Gasoline Plant



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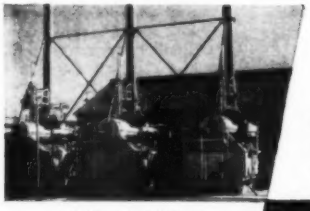

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In April 1950, blocked-out operations charging paraffinic crudes were started. When charging the lighter paraffinic crudes, difficulty was encountered with erratic straightrun gasoline end points due to flooding or priming in the upper section of the crude flash tower. Since the intermediate reflux rate was limited to approximately 300 bbl. per hour by pressure drop through the pump suction line, the loading in the upper section of the tower could be reduced only by decreasing crude-oil rate.

During a shutdown in August 1950, the size of the drawoff line was enlarged to permit an increase in intermediate reflux rate to approximately 600 bbl. per hour. In addition, a differential-pressure recorder was installed across the top 11 trays to detect when flooding began and thus enable the operators to take corrective measures. A sketch of the tower is shown in Fig. 4.

Since making these changes, the average paraffinic crude rate has been increased approximately 1,000 bbl. per stream day. In addition, the improved distribution of reflux has permitted an increase in stripping steam rate to the bottom of the tower by approximately 3,000 lb. per hour. This has reduced the naphtha content of the reduced crude, with a corresponding reduction in the naphtha content of the catalytic cracking unit gas oil recovered by vacuum flashing the reduced crude.

The differential-pressure recorder permits operation at maximum capacity while charging naphthenic crude, particularly toward the end of a run when the crude preheat exchangers become fouled. Since the reduced crude rate is limited by capacity of the pump, the only means of increasing crude rate when crude preheat drops is to increase flashing by reducing the flash zone pressure. The differential-pressure recorder permits the tower pressure to be lowered, with appropriate adjustments in intermediate reflux, without losing control of the tower due to flooding.

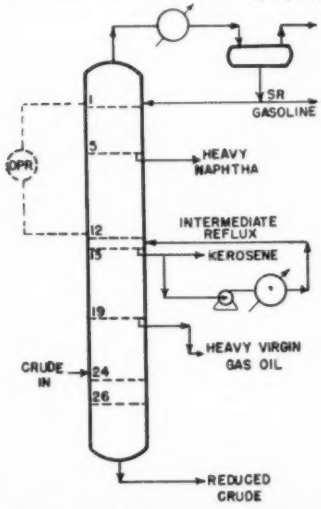

Fig. 4—Hookup of crude flash tower, thermal cracking unit.

Hydrogen Sulfide Absorber

One of the problems frequently encountered in the desulfurization unit is foamover of the circulating amine solution. The hydrogen sulfide removal unit at the Texas City polymerization unit has a 5-ft. by 55-ft. 6-in. absorber containing 18 bubble-cap trays on 24-in. spacing. The unit was designed for 19.2 million standard cubic feet per day of feed at 325 psig.

Carryover of amine solution may occur from three causes: (1) actual flooding of the tower from plugging material on the trays, such as iron sulfide, (2) foaming of the amine solution by soap-like compounds in the amine solution, and (3) inclusion of appreciable amounts of liquid with the gas feed to the absorber.

Although a large knockout drum is provided after the absorber as a safety measure, in early operations liquid carryover collecting in the knockout drum was dumped rapidly to the sewer, representing a considerable monetary loss of amine solu-

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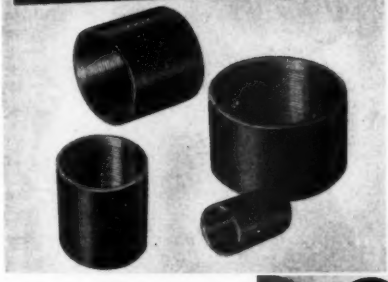

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tion. In addition, during periods of upset, the H_2S is not scrubbed from the catalyst tower feed and high-sulfur polymer gasoline is temporarily produced.

In initial operations first warnings of liquid buildup on the trays were manifested by: (1) a drop in bottoms rate, (2) loss of level in the amine surge drum, and (3) increase in level in the knockout drum. When this occurred, antifoam agent was added to the circulating amine. However, by the time the antifoam agent was added, the damage had been done. In an attempt to anticipate carryover from the absorber, a differential pressure indicating instrument was installed across the absorber about 1½ months after the unit was placed on stream.

The differential-pressure indicator instrument is now used as a criterion of foaming in the absorber, and when the differential pressure starts to increase, 1 qt. of Dow-Corning antifoam "A" is immediately added to the circulating lean amine stream. The effect is almost instantaneous, foaming is arrested, and the differential pressure drops off to normal range. Pressure drop is about 2.0 psi. for normal operation, and climbs to as high as 4-6 psi. during periods of foaming. Antifoam addition has been effective in completely preventing carryover, as long as it is added before complete flooding occurs.

These differential-pressure installations were originally installed on a temporary basis, but have now been capitalized and made permanent. They are considered as necessary control instruments for efficient operation of the refinery units. Applications are being extended wherever they appear feasible. Currently, an application is being tried on one of the refinery towers which is subject to deposition of fouling material on the trays. In this manner, it is hoped to locate the tray on which plugging starts, as well as the time required for complete fouling. The information will be used as an aid in scheduling the shutdown for cleaning so as not to interfere with other maintenance work.

Acknowledgment

Acknowledgment is made by the authors to Pan American Refining Corp. for permission to publish this article, and to the engineering department, the operating department, and members of the chemical engineering division, particularly W. H. Landrum, K. A. Muller, D. G. Schroeter, and I. F. Teykl.

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BOOKS

PROCEEDINGS FOR SECOND OIL-RECOVERY CONFERENCE—A Symposium of Carbonate Reservoirs. Published by the Texas Petroleum Research Committee, University of Texas, Austin. 205 pp. Copies obtainable from George H. Fancher, Texas A. & M. College, College Station, Tex.

This publication, Bulletin 11 of the committee publications, contains 17 papers which were presented at Texas A. & M. last April.

SYMPOSIUM ON ULTRASONIC TESTING. Published by American Society for Testing Materials, 1916 Race Street, Philadelphia, 3. 140 pp. $2.

The 10 papers and discussions included in this book represent a summary of the history, theoretical aspects, basic principles of practical testing, and practical applications for the ultrasonic testing of materials as presented at sessions on the subject, sponsored by A.S.T.M. Committee E-7 on Non-Destructive Testing. Papers presented in the book include: "Ultrasonic Wave Propagation in Materials: A Guide to Theoretical Results," by Louis Gold, Brown University. "Inspection, Processing, and Manufacturing Control of Metals by Ultrasonic Methods," by C. H. Hastings and S. W. Carter, Watertown Arsenal; "Basic Principles of Practical Ultrasonic Testing," by J. C. Smack, Sperry Products, Inc.; "Ultrasonics in the Heavy Forging Industry," by J. C. Hartley, Winchester Repeating Arms Co.

"The Application of Ultrasonics to the Fabrication of Aluminum," by J. V. Carroll, Aluminum Co. of America; "Ultrasonic Testing in Railroad Work," by E. D. Hall, Erie Railroad Co.; "Ultrasonics in the Electrical Industry," by D. M. Kelman, Westinghouse Electric Corp.; "Ultrasonic Testing of Bronze Forgings and Ingots," by A. Piltch, U. S. Naval Gun Factory; "Pulse Techniques Applied to Dynamic Testing," by J. R. Leslie, Hydro-Electric Power Commission of Ontario; and "The Measurement of Dynamic Modulus in Adhesive Joints at Ultrasonic Frequencies," by A. G. H. Dietz, P. J. Closmann, G. M. Kavanagh, and J. N. Rossen, Massachusetts Institute of Technology.

CORROSION and its control

Bonding Nonconductive Pipe Joints

ONE of the prime necessities for the successful installation of a cathodic protection system on a network of piping is that the entire network form an electrical unit. In order to secure this condition, it may be necessary to install bonds to tie together sections of pipe coupled with mechanical devices. Ordinary screwed couplings are almost always highly conductive; no bonding is required. The same is true of flanged joints, except where great care has been taken to insulate them; regardless of the type of gasket employed, the studs will afford a low-resistance path for the flow of current.

Upon the other types of mechanical joint, however, the experienced corrosion engineer has learned to look with suspicion. Electrical continuity is possible, and is, in fact, achieved in the majority of cases—but only one discontinuity is required to interrupt the current. Instances have been found where such joints opened and closed like switches, with the temperature changes of the earth; no leakage was involved—the joints were serving their designed purpose adequately—but the application of cathodic protection under such conditions is impossible; it is even impossible to conduct tests and measurements with any degree of reliability.

In addition to the connection of the entire network into a single electrical unit, so that it may all be protected, there exists another important necessity for bonding nonconductive joints. The piping which is separated from protected piping only by a joint may be exposed to severe corrosive action by the current supplying the protection. This is an extreme case of the isolated metallic structure discussed in a previous article in this series—extreme because of the proximity. With a space of as little as $\frac{1}{16}$ in. to jump, the current leaving one joint of pipe is concentrated into a very small area, and the attack can be very rapid—failures have resulted in as little as 1 week.

Another reason for bonding, even where the joints involved are of the flanged variety, is that of fire safety. If highly inflammable liquids or gases are being handled, it is particularly important to avoid any possibility of an arc or spark. Consequently any bolted connection in a line which is under cathodic protection should always be bypassed with a good bond before separating the flanges. Two separate lines in a single valve pit should always be bonded together—otherwise an accidental contact with a wrench or other metal tool might evoke a spark.

The simplest and safest way to avoid such sparks in valve pits, especially in those where several lines are involved, is that of running a continuous bonding strap completely around the pit, connecting it to every pipe entering or leaving at the point where it passes through the wall. Then all of the piping in the pit must aways be at the same potential, and it will be impossible to draw any kind of electrical arc, regardless of which joints are broken. Valves or fittings may be removed and replaced with complete safety.

When buried piping is exposed by excavation, similar precautions should be taken before any cutting or breaking of joints is done. Temporary bonds should be placed across the intended break, either by means of clamps or by tack welding.

Permanent bonds, either on pipe to be buried or in valve pits as described above, should be of adequate size and mechanical strength. It is not necessary that their electrical resistance be as low as that of the pipe itself, but it should be an appreciable fraction thereof—say a minimum of one-tenth. There is no basis for the apparently widespread conviction that, since these bonds are designed to carry electricity, they should therefore be made of copper. Actually, there are disadvantages to the use of copper, though admittedy they are small.

Should such a bond be buried in low resistivity soil, and should the line not be under cathodic protection, then there exists the possibility of bimetallic or galvanic action between the steel and the copper, to the detriment of the steel. However, since the area of the steel is large compared to that of the copper, such action rarely results in actual damage.

If, however, the disadvantages of copper for this purpose are few, so are the advantages. Ease of application, by brazing or by means of the thermite process is almost the only real advantage. If welding equipment is available, and if the conditions are not too hazardous for its use, flat straps of steel arc welded to the pipe will serve the purpose fully as well as copper. After welding, they should be given a protective coating equal to that on the pipe itself. If the joint being bonded is an expansion joint or a flexible coupling whose movement is anticipated, then the bonding strip should be arched enough to allow the movement without imposing any undue strain on pipe or joint.

Often it will be necessary or advisable to install bonds, either temporary or permanent, in locations where either welding or brazing would be hazardous. Under these circumstances mechanical connections will be necessary. There is no great difficulty involved in making good temporary connections, but great care is required in making permanent mechanical joints which will not deteriorate.

Two leak clamps, connected together by a welded strap (the welding, of course, being done in a safe place) may be installed on either side of a joint. The pipe where the clamps are placed, and the inner surfaces of the clamps, must be very thoroughly cleaned of all coating, rust, paint, and other foreign matter. The metal should be filed bright (not just brushed) and the clamps applied with all the bolts pulled up very tight and evenly. The entire assembly should then be thoroughly primed and coated; or, if the installation is in a pit, painted. Such a joint, carefully made, should remain a good conductor for many years.

Part 28 of a series by Marshall E. Parker, consulting engineer, Houston.

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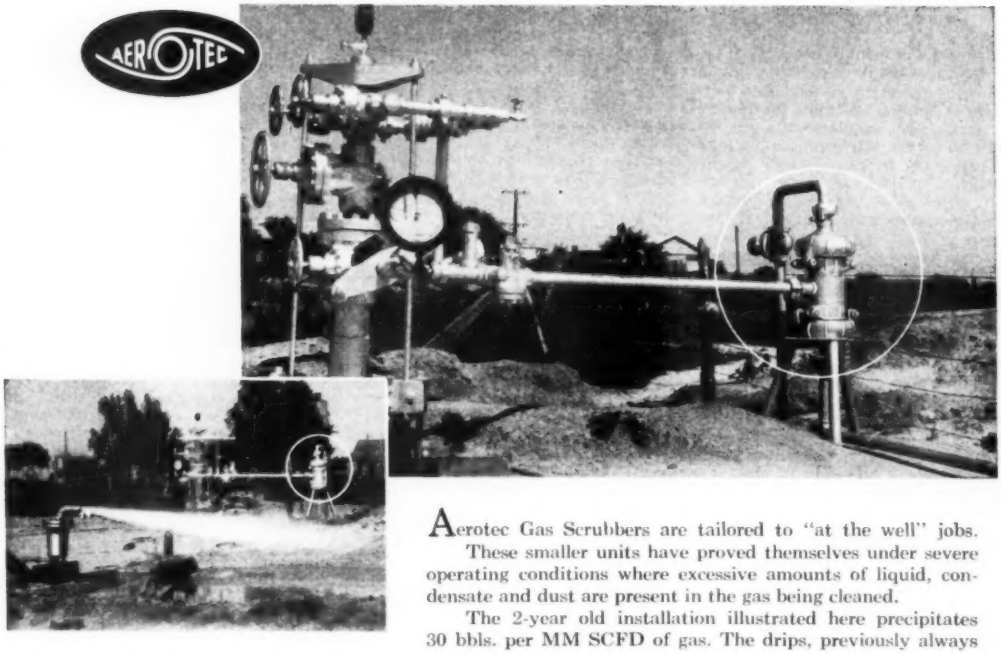

TOP: View of Aerotec Gas Scrubber at the well. The Aerotec unit, in circle, is simple, easy to install and highly efficient.

BOTTOM: Armstrong trap in foreground discharges liquid and solids every 3-4 minutes, from continuous discharge of Aerotec unit in background.

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QUESTIONS on TECHNOLOGY

by W. L. Nelson
Consulting Engineer

Plant Comparison of Value Of Coal and Oil

In your "Relative Value of Coal and Fuel Oil," July 19, 1951, you show that fuel oil is worth more than its value based on its heating value. Have you plant tests to prove this?—M. A. S.

It is not felt that plant experiments are needed in making the comparison except with regard to the exact magnitude of the costs of handling, firing, thermal efficiency, and maintenance, but one set of plant tests will be discussed below.

In the July 5, 1951 (page 106), and July 19, 1951 (page 114), issues of The Oil and Gas Journal, it was found that 4.25 bbl. of fuel oil have about the same heating value as a ton of bituminous coal. It was also found that 4.25 bbl. of fuel oil could be handled and fired for at least 15 to 25 cents less than the cost of burning 1 ton of coal, and in extreme cases the saving with oil fuel might amount to even $1.50 per ton of coal (or 4.25 bbl. of oil). Thus, the ton of coal would have to sell at prices 15 cents to $1.50 below a price based on a ratio of 4.25. The relationship is indicated in Table 1 for several price levels.

TABLE 1—RATIO OF COAL PRICE TO OIL PRICE, WHEN BOTH ARE EQUALLY ECONOMICAL

Oil price ($ per bbl.)	Times	Economy of oil firing ($/4.25 bbl.)	Competitive coal price ($/ton)	Ratio of prices (ton coal/bbl. oil)
1.00	$4.25	0.25-0.50	3.75- 4.00	3.75-4.00
1.50	6.37	0.35-0.60	5.77- 6.02	3.85-4.01
2.00	8.50	0.45-0.70	7.80- 8.05	3.90-4.02
2.50	10.62	0.55-0.80	9.82-10.07	3.93-4.03

The only thing that could alter the ratios of coal price (per ton) to oil price (per barrel) would be to compare fuels of different heating value, such as those that would give base heating value ratios of 4.4 or 3.8 rather than the 4.25 used here. Even such a situation can be handled with ease because it is apparent that the "economic ratio" is 0.2 to 0.5 units lower than the "heating value ratio."

It appears that industry has found that fuel oil is even more economical than the figures given here, because the actual prices of delivered coal and delivered oil (see July 19, 1951, issue) indicate an average ratio over the years of about 3.7 ranging from as low as 2.55 (the year 1948) to as high as 4.76 (the year 1949). It is also obvious that the ratio cannot exceed the basic heating value ratio (3.8 to 4.4) unless fuel oil is being sold at distress prices.

TABLE 2—COMPARISON OF COST FACTORS IN BURNING OIL AND COAL

	Oil	Coal
No. of tests considered	5	5
Cost of fuel (incl. frt.)	†$1.19	*$4.86
Cost of unloading at plant at 4 cents per kw.-hr. (oil)	†$0.00671	*$0.1177
Weight of fuel per unit of measurement (oil at 85° F.)	‡324	§2,000
Cost per lb. for fuel, incl. frt. and unloading, per lb.	$0.005766	$0.003489
B.t.u. per lb. fuel as fired	18,732	13,490
Cost of fuel per million B.t.u. (incl. frt. and unloading)	$0.2011	$0.1845
Net equivalent evaporation from and at 212° F. per lb. (allowing 3.5 per cent for burners in case of oil), lb.	14.245	9.452
Efficiency of boiler and furnace using given fuels, per cent	76.06	67.67
Cost of evaporating 1,000,000 lb. water	$264.51	$263.31
Cost of evaporating 236,000 lb. water (avg. 24-hr. evap.)	$62.12	$61.88
Cost per 24-hr. handling fuel at plant (coal and wood passers)		$3.50
Net cost per 24-hr. operation with given fuels	$62.12	$65.38

*Per ton. †Per barrel. ‡Pounds per barrel. §Pounds per ton.

In the August 1951 issue of Power Engineering (page 86), C. T. Baker reports boiler tests on the burning of oil, coal, cord wood, and wood slabs. The comparison was not entirely proper because the same amount of labor was employed regardless of the fuel being handled but in spite of this unfairness to oil, the tests showed an economic ratio of 4.12 which is 0.28 units below the basic heating value ratio (4.4) of the two fuels that were employed. The boiler plant consisted of two water-tube boilers rated at 200 hp. each, an open-type exhaust steam feed-water heater and a water-treating system. The pressure was 140 psig. with no superheat. The feed water arrived at 210° F. from the feed-water heater. Tables 2, 3, and 4 show the performance of the plant. It will be noted that 3½ per cent of the steam generated was charged for the steam consumed by the oil burners. This amount of atomizing steam is larger than the requirements of modern equipment.

TABLE 3—COMPARISON OF WEIGHTS AND B.T.U. VALUES OF OIL, COAL, WOOD AND SLABS

By Actual Test

	Coal	Oil
Wood, lb.	0.694	0.46
Coal, lb.	1	0.664
Oil, lb.	1.505	1
Slabs, lb.	0.432	0.286
	Coal (tons)	Oil (bbl)
Wood, cords	0.955	3.9
Coal, tons	1	4.08
Oil, bbl.	0.245	1
Slabs, cords	0.752	3.08

By Analysis

	Coal	Oil
Wood, lb.	0.652	0.477
Coal, lb.	1	0.734
Oil, lb.	1.36	1
Slabs, lb.	0.564	0.413
B.t.u. per lb.	13,724	18,732
B.t.u. per unit of measure	27,450,000	6,100,000
	Coal (tons)	Oil (bbl)
Wood, cords	0.896	4.04
Coal, tons	1	4.50
Oil, bbl.	0.222	1
Slabs, cords	0.987	4.45

TABLE 4—COMPARISON OF COSTS FOR EQUAL ECONOMY OF OIL, COAL, WOOD AND SLABS

	Wood				
	Local	By freight	Slabs	Coal	Oil
Weight of fuel per unit of measurement (oil taken at 85° F.)	*3,432	*2,752	*3,500	†2,000	‡325
Net equivalent evaporation per lb. of fuel as fired (assuming 3.5 per cent to be used by burners in case of oil), lb.	6.648	6.563	4.0718	9.452	14.245
Net equivalent evaporation per unit of measurement of fuel (assuming 3.5 per cent to be used by burners in case of oil), lb.	22,822	18,057	14,250	18,904	4,630

	Per cord			Per ton	Per barrel
	$3.50	$2.77	$2.18	$2.90	$0.71
	4.00	3.16	2.50	3.31	0.81
	4.25	3.36	2.65	3.52	0.86
Total costs at which all fuels would be equally economical under actual operating conditions	4.50	3.56	2.81	3.75	0.91
	4.75	3.76	2.97	3.93	0.96
	5.00	3.96	3.12	4.14	1.01
	5.25	4.15	3.28	4.35	1.06
	5.50	4.35	3.43	4.56	1.12
	5.75	4.55	3.60	4.76	1.17
	6.00	4.75	3.75	4.97	1.22

*Pounds per cord. †Pounds per ton. ‡Pounds per barrel.

Note: A car of slabs as ordinarily loaded will average 8.5 cords of 3,500 lb. each. This weight of 3,500 lb. is applicable to comparatively green slabs—that is, to slabs which were sawed from green timber from 5 to 10 days previous to the time the weights were taken.

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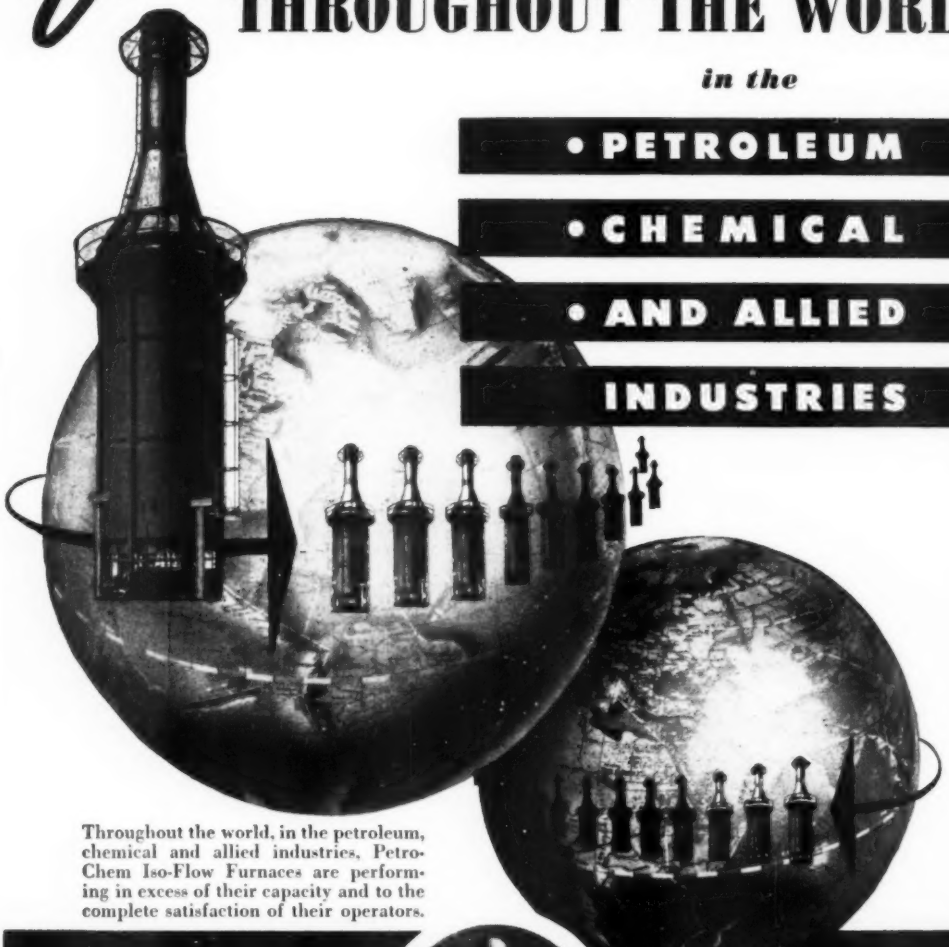

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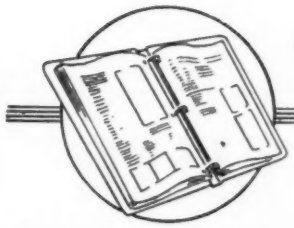

THE REFINER'S notebook

No. 89

Physical Properties of Refractories

by Ray A. Witschey*

REFRACTORIES have been classified as mineralogical in origin. Properties of commercial refractories are derived from the properties of their mineralogical constituents. Table 1 in No. 88 of The Refiner's Notebook tabulated these constituents.[1] In this installment physical properties and tests of commercial refractories are outlined for the convenience of the reader who may have to deal with these materials in refinery furnace applications.

Many standard tests are used to determine the physical properties of refractories. Standardization of tests has largely been the work of the American Society for Testing Materials, Committee C-8, consisting of qualified representatives of producing, consuming, and general interest groups. This committee is constantly formulating and revising standard and tentative specifications, classifications, methods of testing, and definitions pertaining to refractories. Some of these tests are described briefly.

Pyrometric cone equivalent (P.C.E.). — Fire-clay refractories have no true melting point but soften over a range of temperature. The standard Pyrometric Cone Equivalent (P.C.E.) is a time-honored method of determining softening behavior. Softening behavior (or refractoriness) is a function of time and temperature.

The standard method of determining P.C.E. is described in detail in A.S.T.M. Method C-24. It consists essentially of molding a small test cone from the refractory, mounting in a ceramic plaque with a series of standard pyrometric cones, and heating the plaque in a definite manner until the test cones soften and bend. The number of the standard cone which shows the same degree of deformation is reported as the P.C.E.

Thermal expansion.—This is the term used to describe the property of expanding on heating, and contracting on cooling. If this heating is not carried to the point at which permanent high-temperature volume changes occur, the refractory will return to its original dimension. This property is designated as "reversible thermal expansion."

A number of methods are employed for determining coefficient of thermal expansion of refractories. The more satisfactory methods include (1) the interferometer method, (2) the fused quartz-tube method, and (3) the high-temperature-furnace micrometric method. None of these have been designated as standard by A.S.T.M. Reversible thermal expansion is indicated as a function of dimensional change with temperature. This change may be expressed as a percentage, or in inches per foot.

Reheat.—The property of a refractory to show volume changes at high temperatures is referred to as reheat behavior. A refractory may exhibit volume stability and show no permanent change, or it may exhibit permanent reheat "shrinkage" or permanent reheat "expansion." The standard procedure for determining reheat is A.S.T.M. Method C-113. The standard reheat tests on fire-clay refractories are conducted at 2,460° and 2,550° F. The reheat value is expressed in "per cent of contraction or expansion."

Hot load test. — This describes the behavior of a refractory under load at high temperature. The standard test for fire-clay refractories is described in A.S.T.M. Method C-16. In this test a 9-in. brick is placed on end in a furnace, loaded at 25 psi., and heated at a prescribed rate to a given temperature. This maximum temperature is maintained for a definite time and the furnace permitted to cool. The subsidence is expressed in per cent and the temperature usually employed in testing fire-clay refractories is 2,460° and 2,640° F.

Panel spalling test.—This is conducted to determine the resistance of fire-clay refractories to the separate and combined effects of structural and thermal spalling under conditions believed to simulate the same type of spalling as encountered in service. Spalling is defined as "the breakage or crushing of a refractory unit due to thermal, mechanical, or structural causes, presenting newly exposed surfaces of the residual mass."

Spalling is determined quantitatively by a series of standard procedures described in A.S.T.M. Methods C-38, C-107, C-122, and C-180. The test is conducted with movable panels of refractory approximately 18 in. square and 4½ in. thick. The panels are insulated on one side and the other side exposed to (1) a suitable heat treatment of 24 hours at 2,910° F or 3,000° F., and (2) a thermal shock treatment consisting of subjecting the exposed surface to an alternate heating and cooling cycle. Results are expressed in per cent of loss in weight of the refractory in the panel.

Mass.—This is the collective term sometimes used in summarizing the collective properties of apparent porosity, water absorption, apparent specific gravity, bulk density, true specific gravity, true density, etc. Standard A.S.T.M. Methods C-20 (for apparent porosity and water absorption, C-134 (for bulk density), and C-135 (for true specific gravity) have been adopted.

To be more specific, (1) apparent porosity expresses as a percentage the relationship of the volume of the open pores to exterior volume, (2) water absorption expresses as a percentage the relationship of the weight of water absorbed to the weight of the dry specimen, (3) apparent specific gravity is the ratio between the weight of a brick (in grams) and the volume of brick less the volume of the open pore spaces (in cubic centimeters), and (4) bulk density is the ratio between the weight of a brick and its exterior volume and is obtained by dividing the weight of the brick by the volume.

*Ceramic engineer, A. P. Green Fire Brick Co. Portion of paper presented at John Zink Heating Seminar, Tulsa, 1951.

Reference

1. Phelps, S. M., Properties of Refractory Materials, A.R.I. Bulletin No. 86, Nov. 1948.

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ENGINEERING fundamentals

No. 460

Effect of Connate Water on Flood Calculations

IN previous discussions the calculation of a linear flood advance has been given and it has been shown that both relative permeability and viscosity enter into the calculation. It was assumed for simplicity that no connate water was present in the systems flooded. A calculation can be made with connate water included and its presence will produce a variation in the calculated water saturation at breakthrough of the flood front.

The calculation when connate water is present is explained by reference to Fig. 1, a plot of water saturation versus distance with the flood front designated to be at the distance x from the inlet end of the system. The total water present in the system up to the point x at any time is:

$$\phi A \int_0^x S_w \, dx$$

Part of this water was present as connate water, the amount being, $\phi A S_{wi} x$, where S_{wi} is the connate-water saturation. The remainder of the water is that injected, and still retaining the assumption that no water moves ahead of the flood front, this is Q_t. Therefore:

$$Q_t + \phi A \times S_{wi} = \phi A \int_0^x S_w \, dx \quad (1)$$

The integral of $S_w \, dx$ can, however, be divided into two parts,

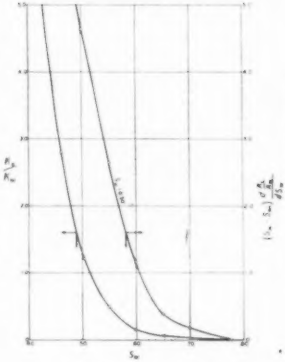

Fig. 2—Relative-permeability ratio vs. saturation.

designated as the areas A and B of Fig. 1, so that:

$$\int_0^x S_w \, dx = \int_{S_{wx}}^{1.0} \Delta x \, dS_w + x S_{wx} \quad (2)$$

where Δx is defined as equal to $(df_w/dS_w) Q_t/\phi A$ and x is given by the equation $(df_w/dS_w)_{S_{wx}} Q_t/\phi A$.

Substituting Equation 1 and values of x and Δx into Equation 2 gives:

$$Q_t/\phi A + (df_w/dS_w)_{S_{wx}} S_{wi} Q_t/\phi A = \int_{S_{wx}}^{1} (Q_t/\phi A) (df_w/dS_w) \, dS_w + (Q_t/\phi A) (df_w/dS_w)_{S_{wx}}$$

which simplifies to:

$$(f_w)_{S_{wx}} = (S_{wx} - S_{wi}) (df_w/dS_w)_{S_{wx}} \quad (3)$$

Equation 3 is, therefore, the condition for finding the flood front saturation.

By substituting in Equation 3 the expressions for f_w and the derivative of f_w with saturation as used in Engineering Fundamentals No. 458, the equation becomes:

$$\mu_o/\mu_w + k_o/k_w = (S_{wx} - S_{wi}) [d (k_o/k_w)/dS_w]_{S_{wx}} \quad (4)$$

At the time this flood front reaches the end of the system, L, the fractional water saturation is given by:

$$(1/L) \int_0^L S_w \, dx$$

(Continued on next page)

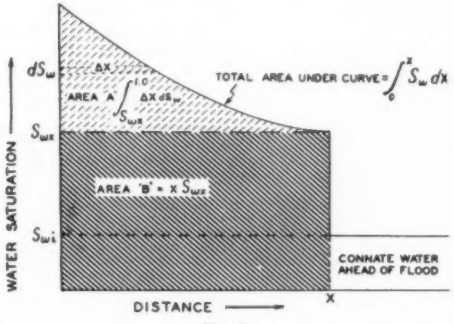

Fig. 1.

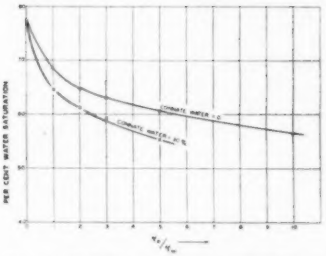

Fig. 3—Variation of water saturation at breakthrough with connate water.

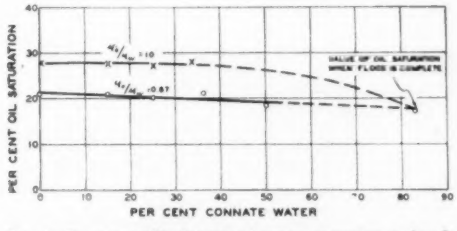

Fig. 4—Experimentally determined water saturation at breakthrough vs. connate-water content.

Series by John C. Calhoun, Jr., Chairman, Petroleum Engineering School, Penn State College

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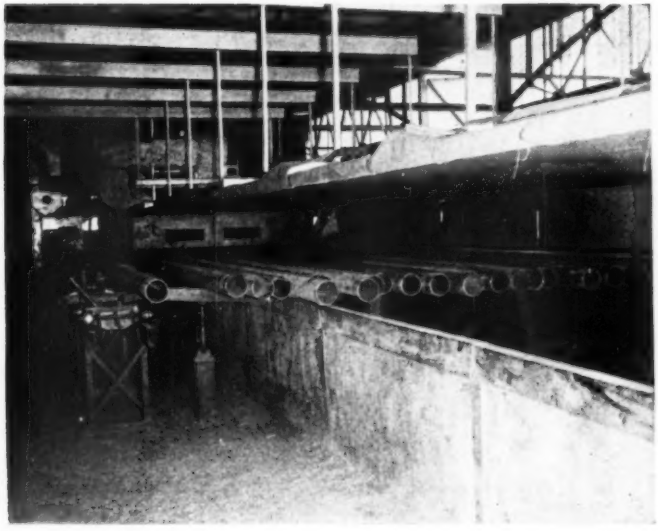

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Again, using Equation 1 this becomes:

Water saturation at breakthrough $= Q_t/\phi AL + S_{wi}$.

But $Q_t/\phi AL = 1/(df_w/dS_w)_{S_{wx}}$, so that

Water saturation at breakthrough

$$= (S_{wx} - S_{wi})/(f_w)_{S_{wx}} + S_{wi} \quad (5)$$

Therefore, by using a plot of k_o/k_w versus S_w and a known value of connate water the variation of flood-front saturation can be found by Equation 4 and the water saturation at water breakthrough by Equation 5. For illustration, the plot of relative permeability ratio used is in Fig. 2. A value of connate water equal to 30 per cent is chosen because it is the value of water saturation at which the oil relative permeability is zero. Fig. 3 gives the variation of water saturation at breakthrough as a function of the viscosity ratio calculated by Equations 4 and 5. For comparison there is also shown the variation when no connate water is present (calculated in Engineering Fundamentals No. 458).

It is apparent that the presence of increasing amounts of connate water will always calculate lower water saturations at breakthrough for a given viscosity ratio, because the flood front is assumed to be found by a material balance based on the amount of water injected. An examination of Equation 4 shows that the effect of higher values for S_{wi} is equivalent to greater values of μ_o/μ_w. It has already been shown that the water saturation at breakthrough will decrease with this change.

Experience in flooding is usually the opposite of that shown in Fig. 3. For example, Fig. 4 shows results of flooding in the laboratory where increasing connate water increased the water saturation at breakthrough at two different viscosity ratios.[1]

Reference

1. Meltzer, David, M.S. Thesis, University of Oklahoma, 1950.

BOOKS

PROPERTIES OF LUBRICATING OILS AND ENGINE DEPOSITS. By C. A. Bouman. Published by the Macmillan Co., 60 Fifth Avenue, New York. 170 pp. $3.

In this book the author deals briefly with the principles and problems underlying the lubrication and fouling of internal-combustion engines. Extensive use is made of results obtained at the Delft laboratory of the Royal Dutch-Shell Group where he is a member of the staff. After a general introduction on lubrication, the author discusses the classification of lubricating oils and their manufacture. Tests for fresh oils are given. The various forms of contamination likely to be present are dealt with and their effects in the engine in service are described. The book contains much tabulate material including conversion tables for kinematic viscosity, Saybolt Universal viscosity, and Engler viscosity

Pipe-Line Construction

FOLLOWING is a tabulation of pipe-line projects which are planned or under construction. Included are crude-oil, products, and natural-gas lines. This list is compiled from surveys made by The Oil and Gas Journal.

Crude-Oil Pipe Lines

Alberta-Vancouver Oil Pipe Line Co. (Brokaw, Dixon, McKee).—972 miles, 16-in., proposed, Edmonton via Pincher Creek, Alta., Idaho and Washington states to Vancouver, B. C.

Continental Pipe Line Co.—105 miles, 8-in., authorized, Rincon to northwest of Sullivan City on to Port Isabel, Tex. Completion date 1952.

Continental Pipe Line Co.—217 miles, 12-in., authorized, Wichita Falls, Tex., to Ponca City, Okla. Completion date 1952.

Derby Oil Co.—15 miles, 6-in., authorized, Wichita to Bentley, Kans. Completion date 12-51.

Gulf Refining Co.—87 miles, 14-in., authorized, Lumberton to Mobile. Completion date 1-1-51.

Ohio Oil Co.—117 miles, 22-in., authorized, Sheridan, Ind., to Lima, Ohio.

Pan American Pipe Line Co.—27 miles, 26-in., Genoa to Texas City, Tex. Completion date 12-52.

Pan American Pipe Line Co.—40 miles, 14-in., Arden Station in Irion County to Eldorado Station in Schleicher County. 6-52.

Phillips Pipe Line Co.—27 miles 8-in., looping from Borger, Tex., to Yale, Okla.

Phillips Pipe Line Co.—Authorized, Midland, Glasscock, Reagan, and Upton counties.

Platte Pipe Line Co.—1,075 miles, 16-20-in., under way, Worland, Wyo., to Wood River, Ill.

Platte Pipe Line Co.—573 miles, 16-20-in., under way, Winchester, Wyo., to Brule, Neb. R. H. Fulton & Co. (Sections 1, 2, 3, and 4.—Section 1, 126 mi. of 16-in., remainder 20-in.). A. A. Carrigan, spreadman at Casper, Wyo., field office.

Platte Pipe Line Co.—142 miles, 20-in., under way, near Marysville, Kans., to Holdredge, Neb. Bishop & Lock (Section 5); H. LaQuey, spreadman.

Platte Pipe Line Co.—100 miles, 20-in., under way, northern edge of Kansas. Rumsey Bros., contractor of Section 6.

Platte Pipe Line Co.—(Section 7). 274 miles, 20-in., Missouri River to Salisbury, Mo., and (Section 8) Salisbury to Mississippi River, under way, field office, Mexico, Mo., B. C. Hall, spreadman; River crossing field office, Hartford, Ill., Dick Jernigan, spreadman.

Progress Pacific Pipe Line Co.—900 miles, 20-in., proposed, Permian basin, West Texas, to California.

Rancho Pipe Line System.—464 miles, 24-in., authorized, McCamey to Houston, Tex. Company crews. Completion date 1952. (Joint project with Sinclair Pipe Line Co., Pan American Pipe Line Co., Tidewater Pipe Line Co., Nantucket Pipe Line Co., and Phillips Pipe Line Co., with Shell Pipe Line Corp. handling construction and operation.)

Rancho Pipe Line System.—66 miles, 8-in., authorized, Gohlke to La Grange, Tex. Company crews. Completion date 1952.

Roosevelt Oil & Refining Corp.—22 miles, 4 and 6-in., authorized, St. Helens to Norwich, Mich.

Service Pipe Line Co.—20 miles, 20-in., authorized; Drumright, Okla., to Humboldt, Kans.; 19 miles, 16-in., authorized, Freeman, Mo., to Sugar Creek, Mo.; 63 miles, 10-in., authorized, Cogdell to Old Glory, Tex.; 30 miles, 20-in., authorized, Freeman to La Plata, Mo.; 24 miles, 10-in., authorized, Denton, N. M., to Wasson, Tex.

Sinclair Pipe Line Co.—674 miles, 22-24-in. authorized; Drumright, Okla., to E. Chicago, Ind.

Texas-New Mexico Pipe Line Co.—75 miles, 8-in., planned, Midland to Germania pool; Midland to Scarborough and Sweetie Peck area; and Crane station to McElroy area, West Texas.

Texas-New Mexico Pipe Line Co.—55 miles, 8-in., planned, Eunice to Covington and Saunders area, New Mexico.

Trans-Mountain Oil Pipeline Co. (Sponsored by Bechtel Corp.)—715 miles, under way by July 1951, Edmonton, Alta., via Yellowhead Pass to Vancouver, B. C.

West Texas Gulf Pipe Line Co.—467 miles, 26-in., authorized, Colorado City to Wortham, Tex., 26-in.; Wortham to Sour Lake, Tex., 24-in. Completion date 10-52.

West Texas Gulf Pipe Line Co.—114 miles 20-in., authorized, Wortham to Longview Tex. Completion date 10-52.

Products Pipe Lines

Bell Oil & Gas Co.—150 miles, 6-in., planned, Ardmore to Drumright, Okla.

Buckeye Pipe Line Co.—430 miles, 14-in., proposed, Linden, N. J., to Allentown, Pa., Junction; Chelsea, Pa., via Allentown Junction to Auburn, Rochester, Syracuse and Oswego, N. Y. Start 1952; finish 1953.

Ohio Oil Co.—24 miles, 8-in., authorized, East St. Louis to Wood River, Ill.

Phillips Petroleum Co.—163 miles, 12-in. looping from Borger, Tex., to Paola, Kans. Completion date 11-1-51.

Phillips Petroleum Co.—137 miles, 10-in., looping from Paola, Kans., to East St. Louis, Ill. Completion date 11-1-51.

Phillips Petroleum Co.—198 miles, 8-in. looping from East St. Louis, Ill., to East Chicago, Ind. Completion date 11-1-51.

Plantation Pipe Line Co.—707 miles, 14 and 18-in., under way, Baton Rouge to Charlotte, N. C., 275 miles, 14-in., under way, Bremen to Charlotte, N. C.; 432 miles, 18-in., under way, Baton Rouge to Bremen, Ga.; 220 miles, 18-in., Baton Rouge to Mississippi-Alabama state line; Williams Brothers Co. David R. Williams, Jr., project manager.

Plantation Pipe Line Co.—200 miles, 14-in., under way, Winder, Ga., to Charlotte N. C. Williams Bros., contractor. T. E. Davis, spreadman at Athens, Go. Completion date 10-1-51.

Progress Pacific Pipe Line Co.—900 miles, 10-in., proposed, California to West Texas.

Salt Lake Pipe Line Co.—Proposed, Pasco Wash., to Puget Sound.

Sinclair Pipe Line Co.—8-in., proposed, Sinclair, Wyo., to Salt Lake City, Utah; 10-in., Houston to Baton Rouge; 16-in., Kalamazoo to Detroit; 20-in. Marcus Hook to Bayonne, N. J.; East Chicago to South Bend, Ind.

Standard Oil Co. (Ind.).—144 miles, 8-in under way by early fall, Neodesha, Kans., to Sugar Creek, Mo.

Standard Oil Co. (Ohio).—17 miles, 6-in., authorized, Toledo to West Toledo, Ohio.

Tuscarora Oil Co., Ltd.—61 miles, 10-in., authorized, Knappenberger to Midland, Pa

Natural-Gas Pipe Lines

Algonquin Gas Transmission Co.—276 miles, proposed, Greenwich, Conn., to Boston area; 492 miles, proposed, laterals-New England area.

Amere Gas Utilities Co.—11 miles, 8-in., authorized KA-5 loop, Priceton and Athens, W. Va. Completion date December 1951.

Amere Gas Utilities Co.—16 miles, 8⅝-in., proposed, loops from Mercer County to Princeton, W. Va.

Amere Gas Utilities Co.—15 miles, 8⅝-in., proposed, near Dameron to Flat Top, W. Va.

Associated Natural Gas Co.—88 miles, authorized, Missouri.

Associated Natural Gas Co.—14 miles, 6-in., under way, Sikeston to Charleston, Mo.

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Carolina Natural Gas Corp.—185 miles, 2-12-in., proposed, lateral lines off Transcontinental in North and South Carolina.

Central Kentucky Natural Gas Co.—12 miles, 20-in., contemplated, loops Means, Ky., to Foster, Ky. Completion date 10-15-51; 7 miles, 12¾-in., Winchester to Middletown, Ky., Davis & Armentrout Construction Co. Completion date 12-51.

Cities of Booneville and Baldwin, Miss.—98 miles, ¾ and 6-in., under way, Booneville and Baldwin, Miss.; M. L. Hulcher Co., Inc., contractor, Sam Carnahan, spreadman. Completion date November 1, 1951.

Cities Service Gas Co.—177 miles, 4-30-in., under way, Grant, Stanton, Hamilton, Kearny, and Finney counties, Kansas. Vaughn & Taylor Construction Co., Inc. Completion date 11-15-51.

Cities Service Co.—80 miles, 4-22-in., under way, Grant, Haskell, and Seward counties, Kansas. Cheek Construction Co. Completion date 12-1-51.

Cities Service Gas Co.—179 miles, 4-30-in., gathering system in vicinity of Ulysses, Kans. Vaughn & Taylor Const. Co., Inc. D. D. Vaughn, spreadman, Ulysses.

Coast Counties Gas & Electric Co.—41 miles, 3, 4, and 8-in., planned, Coast and Valley region, California.

Colorado Interstate Gas Co.—250 miles, 20-in., under way, Kit Carson, Colo., to Amarillo, Tex. R. H. Fulton & Co., contractor. Jerry Nash, spreadman at Lamar, Colo.

Commonwealth Natural Gas Corp.—53 miles, 20-in., proposed, West Bend, Ky., to Norfolk, Va.

Consolidated Gas Utilities Corp.—24 miles, 10¾-in., authorized, Marlow field to Fort Sill, Okla. Completion date 12-1-51.

Dow Chemical Co.—70 miles, various sizes, Midland, Saginaw, and Bay City, Mich.; Mahoney Contracting Co., contractor, Ralph Bucher, spreadman at Midland.

East Ohio Gas Co.—65 miles, 26-in., under way, near Petersburg to Cleveland, Ohio. Williams Bros., contractor. Completion date 12-1-51.

East Tennessee Natural Gas Co.—172 miles, 22-in., authorized, Greenbrier to Oak Ridge, Tenn.

East Tennessee Natural Gas Co.—100 miles, 16-in. proposed, Knoxville to Kingsport, Tenn.

Egyptian Natural Gas Co.—80 miles, 6-8-in., authorized, Norris City to Salem-Centralia, Ill., area.

El Paso Natural Gas Co.—122.9 miles, 30-in., proposed, looping along main line in Texas, New Mexico, Arizona.

El Paso Natural Gas Co.—470 miles, 24-in. under way, San Juan basin, New Mexico to Franconia, Ariz. Completion date 10-1-51.

Empire Southern Gas Co.—22 miles, 2-3-4-in., authorized, Ozona, Crockett County, Texas, to Ozona Distribution system.

Equitable Gas Co.—17 miles, 16-in., under way, near Pittsburgh. H. L. Gentry Const. Co., contractor. Lavern Curtis, spreadman at Sewickley, Pa.

Grand Valley Pipe Line Co.—105 miles, 8-10-in., planned, Piceance Creek field to Rifle on to Grand Junction, Colo.

Gulf Michigan Transmission Corp.—680 miles, 30-in., proposed, Perryville, La. across Arkansas, Missouri, and Illinois to terminus near St. John, Ind.

Home Gas Co.—17 miles, 12-in., proposed, loops from Hancock to Sanford, N. Y.

Iowa-Illinois Gas & Electric Co.—41 miles, 10-in., authorized, Washington County to Cedar Rapids, Iowa.

Kansas-Nebraska Natural Gas Co., Inc.—60 miles, 8-10-12-in., under way, Grand Island to Albion, Neb.

Kansas-Nebraska Natural Gas Co.—65 miles, 2-8-in., planned, Big Springs field to Ogallala, Neb., and to Ovid, Colo.

Kansas-Nebraska Natural Gas Co., Inc.—39 miles, 4 and 6-in., planned, Neligh to O'Neill, Neb., 54 miles, 4 and 6-in. planned, Neligh to Hartington, Neb. (extension). Completion date 1952.

Kansas Power & Light Co.—27 miles, 20-in., authorized, Pratt, Kans., to Calista compressor station.

Lion Oil Co.—140 miles, 6-30-in., gather-

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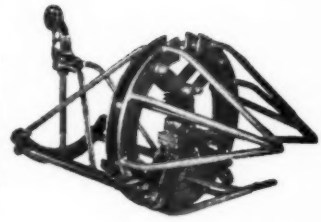

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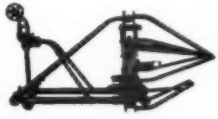

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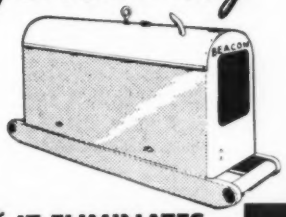

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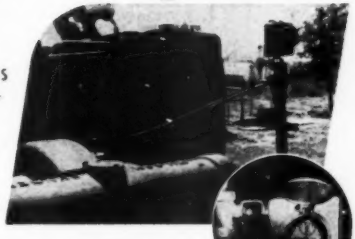

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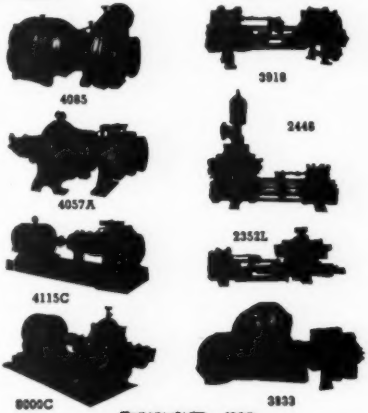

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ing system for Diamond "M" Sharon Ridge refinery. George Tucker Pipe Line Const. contractor. Completion date 10-31-51.

Manufacturers Light & Heat Co.—78 miles, 16-in., contracted, Berwindale, Pa., to near Saltsburg, Pa. Britton Construction Co., contractors.

Michigan Consolidated Gas Co.—131 miles, 24-in., under way, Austin Storage fields to Detroit. Anderson Bros. Corp., contractor. Completion date 11-1-51.

Michigan Gas Storage Co.—94 miles, 8-24-in., authorized, Laingsburg to Mt. Clemens, Mich.

Michigan Consolidated Gas Co.—180 miles, 24-in., planned, Austin, Mich., to Detroit.

MidSouth Gas Co.—240 miles, proposed, Greene, Poinsett, Crittenden, St. Francis, Lee, Phillips, Monroe, Woodruff, and Cross counties, Arkansas.

Montana Power Co.—18 miles, 16-in., proposed, Pakowki Lake area to Canada-Montana border.

Montana Power Co.—52 miles, 16-in., proposed, Canada-Montana border to Cut Bank, Mont.

Mississippi River Fuel Corp.—98 miles, 16 and 18-in., authorized, feeder line from Lincoln Parish, La., to Waskom field, Harrison County, Texas.

Mississippi River Fuel Corp.—40 miles, 18-in., authorized, Dubach to Perryville, La.

National Utilities Co. of Michigan.—76.7 miles, 20-in., proposed, South Central Michigan. (22 miles from near Marshall south to Coldwater; 20 miles east to Hillsdale; 22 miles southwest to Sturgis; 5 miles from Hillsdale to Jonesville and 6 miles west to Union City.)

Nevada Natural Gas Pipe Line Co.—114 miles, proposed, Topock, Ariz., to Las Vegas, Nev.

New River Gas Co.—50 miles, planned, Summers or Monroe counties, W. Va., to Narrows and Dublin, W. Va.

New York State Natural Gas Corp.—35 miles, 20-in., authorized, loops from Dryden, N. Y., to Therm City compressor station.

New York State Natural Gas Corp.—36 miles, 20-in., under way, Potter County, Pennsylvania, to Livingston and Monroe counties, New York. Williams-Austin Co., contractor.

New York State Natural Gas Corp.—36 miles, 20-in., authorized, New Kensington to South Bend, Pa.

New York State Natural Gas Corp.—81 miles, 20-in., authorized, New Kensington, Pa., to Ohio line.

New York State Natural Gas Corp.—27 miles, 16-in. authorized, looping in Greene and Westmoreland counties.

New York State Natural Gas Corp.—79 miles, 20-in., planned, North Oakford, Pa. to Ohio state line.

New York State Natural Gas Corp.—62 miles, 20-in., under way, Murrysville, Pa., to Petersburg, Ohio; 37 miles, 20-in., under way, Lawrenceville, Pa., to Ithaca, N. Y. Field office, Lawrenceville, Pa. Completion date October 1951; 23 miles, 20-in., contracted, state line station to Angelica, N. Y. Office, Wellsville, N. Y. Completion date October 1951; 83½ miles, 20-in., under way, Utica to Ithaca, N. Y. Field office, Clinton, N. Y.; completion date 11-15-51; 85 miles, 16-in., under way by September, Utica to Albany, N. Y. 39 miles, 16-in., under way, Amsterdam to Albany, N. Y., Leman Creech, spreadman at Schenectady, N. Y.; 20 miles, 20-in., under way, Boom Station Tioga County, Pennsylvanian, to Big Flats near Horsehead, N. Y.; Williams-Austin Co., contractor, Ed Peters, over-all general supt.

New York State Natural Gas Co.—77 miles, 20-in., under way, Indiana Pa., to Petersburg, Ohio. Williams Bros., contractor Clyde Gregory, spreadman at Leechburg, Pa. Completion date 10-31-51.

New York State Natural Gas Co.—23 miles, 16-20-in., contracted, Waynesburg to Colvin Gate, Pa. Pipe Line Const. & Drlg. Co.

New York State Natural Gas Co.—65 miles, 26-in., authorized, Ohio-Pennsylvania state line northwesterly to Summit County, Ohio.

Niagara Mohawk Power Corp.—40 miles, 10-12-16-in., under way, lateral lines at Utica, N. Y.; 55 miles, 10-in., Fulton to Watertown, N. Y.; Williams-Austin Co., contractor, Howard Bauer, supt.

Northeastern Gas Transmission Co.—124 miles, 24-in., under way, New York-Mass state line to point north of Boston. Oklahoma Contracting Co., contractor. H. A. Wiley, spreadman at Tewksbury, Mass.; M. E. Shiflett, spreadman at Farmington, Mass.; J. E. Flanagan, spreadman at Sturbridge, Mass.

Northeastern Gas Transmission Co.—511 miles 20-24-in., authorized, New Hampshire, Massachusetts, and Connecticut.

Northeastern Gas Co.—411 miles, proposed, New England towns.

Northern Natural Gas Co.—580 miles, proposed, Kansas, Texas, Oklahoma, and Nebraska loops.

Northern Natural Gas Co.—370 miles, 4-26-in., authorized, gathering lines in Hugoton field.

Northern Natural Gas Co.—217 miles, 26-in., under way, Palmyra, Neb., to Skellyville, Tex. G. G. Griffis Const. Co., contractor; field office, Beatrice, Neb.; G. L. Mims, superintendent; E. G. Grisham, spreadman.

Northern Natural Gas Co.—210 miles, 26-in., proposed, five loops in Texas-Oklahoma area, two in Kansas, and two in Nebraska.

Northern Natural Gas Co.—181 miles, 4-12-in., contracted, gathering system in Hugoton area. Reese Bros. Const., contractor.

Northern Indiana Fuel & Light Co.—33 miles, 8-in., proposed, Edgerton to Auburn, Ind.

Northwest Natural Gas Co.—750 miles, planned, Washington, Oregon, and Idaho.

Ohio Fuel Gas Co.—22 miles, 16-in. authorized, Dayton, Troy, Piqua, and Sidney, Ohio.

Ohio Fuel Gas Co.—23 miles, 16-20-in., authorized, Wellington to Elyria, Ohio; 16 miles, 20-in., authorized, Benton Station, to Crawford Station, completion date 11-15-51; 18 miles, 20-in., Crawford Station, to near Columbus, completion date 12-31-51; 16 miles, 16-in., authorized, Berlin Heights

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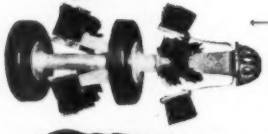
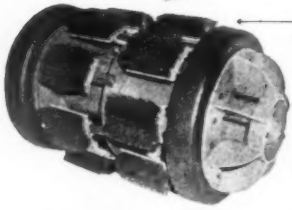
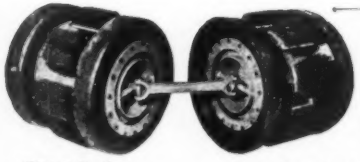


8" Size — TYPE WC-11 — 8" to 14". Will traverse 6 foot radius field bends, full diameter side opening at 45°. SPRINGS COMPENSATE for BRUSH WEAR.



20" Size—TYPE GP-2—16" to 30". 200 LB. SPRING Forces the Brushes against pipe wall —COMPENSATING for WEAR. Will traverse round-opening gate valves. SPRINGS and BRUSHES are identical and interchangeable for all types and sizes of GP PIGS.



24" Size — GP-3 — 18" to 30" Sizes will pass 1½R-90° Bends. SPRINGS COMPENSATE for BRUSH WEAR, ASSURING Full section cleaning efficiency. GP-3 consists of two Type GP-1 Pigs. — Each Unit may be used as individual pig.

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to Sandusky, Ohio, completion date 12-31-51.

Ohio Fuel Gas Co.—74 miles, 3 to 20-in., authorized, Hocking, Knox, and Ashland counties, Ohio.

Ohio Fuel Gas Co.—47 miles, 20-in., authorized, Benton Township, Hocking County, to Columbus, Ohio.

Ohio Fuel Gas Co.—61 miles, authorized, northern and southwestern Ohio.

Oklahoma Natural Gas Co.—16 miles, 8⅝-in., authorized, Shamrock to Cushing, Okla.; 33 miles, 24-in., authorized, Depew to Kellyville, Okla.; 9 miles, 12¾-in., Stroud to Depew, Okla.

Oklahoma Natural Gas Co.—40 miles, 16-in., under way, Ninnekah, Okla., to County Line, Okla.; Trojan Construction Co., contractor.

Oklahoma Natural Gas Co.—26 miles, 12-in., authorized, Ringwood to Enid, Okla. Completion date January 1952.

Oklahoma Natural Gas Co.—40 miles, 2-36-in., authorized, Ringwood field gathering system. Completion date January 1952.

Pacific Gas & Electric Co.—44 miles, 8-in., under way, Salinas to King City, Calif.

Pacific Gas and Electric Co.—141 miles, 34-in., proposed, parallel sections along Topock-Milpitas line.

Pacific Gas & Electric Co.—10 miles, 10-12-in., authorized, Monterey to Fort Ord to Castroville; 12 miles, 16-in., Napa Wye to Shellville; 6 miles, 12-in., Cotati to Santa Rosa, Calif.

Pacific Northwest Pipe Line Co.—400 miles, 22-in., gathering lines on Texas Gulf Coast to Pacific Northwest pipe line.

Pacific Northwest Gas Pipe Line Corp.—1,175 miles, planned, Wharton County, Texas via Oklahoma, Kansas, Fort Collins, Colo., to Portland, Ore., Tacoma and Seattle, Wash.

Pan American Gas Co.—40 miles, 16-in., under way, Winnie to Texas City, Tex., Anderson Bros., contractor. Completion date 10-1-51.

Panhandle Eastern Pipe Line Co.—70 miles, 24-26-in., under way, looping from Sneed, Tex., to Emporia, Kans.

Panhandle Eastern Pipe Line Co.—174 miles, 30 and 26-in., contracted, Tuscola, Ill., eastward—looping present system; R. A. Conyes, contractor. 44 miles, 26-in., Edgerton, Mich.; Anderson Bros.: 22 miles, 30-in., looping in Tuscola, Ill.; 45 miles, 30-in., looping in Montezuma, Ind.; 63 miles, 30-in., looping in Zionsville, Ind.

Pennsylvania Gas Co.—52 miles, 12-in., between Warren and Erie, Pa. (Sect. 1—27 miles, under way and contracted by Harford Bros. Sect. 2—25 miles.

Peoples Natural Gas Co.—25 miles, proposed, Cambria and Blair counties, Pennsylvania.

Phillips Petroleum Co.—118 miles, 3-22-in., under way, Sherman and Hansford counties, Texas gas-gathering system; Vaughn & Taylor Construction Co., Inc., Dumas, Tex., J. F. Crawford, spreadman at Texhoma, Okla.

Piedmont Natural Gas Co.—28 miles, 6-in., proposed, North Carolina—laterals from Transcontinental gas system.

Prince George's Gas Corp.—20 miles, 22-in., authorized, between Chillum and Rockville, Md.

Public Service Co. of North Carolina.—33 miles, 10-in., authorized, Burlington to Chapel Hill, N. C., completion date 3-1-52; 16 miles, 8-in., authorized, Chapel Hill to Raleigh, N. C., completion date 7-1-52; 29 miles, 4-in., authorized, Statesville to Kanapolis, N. C., completion date 7-1-52; 83 miles, 8-in., authorized, Kings Mountain to Asheville, N. C., completion date 3-1-53.

Rockland Light & Power Co.—22 miles, 8-in., proposed, Orangetown to Tompkins Cove, N. Y.

Southern California Gas Co.—35 miles, planned, Antelope Valley, California.

Southern California Gas Co. and **Southern Counties Gas Co.**—15 miles, 30-in., under way, 104th and Crenshaw to Sunset and Sullivan Canyon. Roy Phillips, spreadman at Paramount, Calif.; completion date 10-15-51; 36 miles, 6-8-in., contracted, Palmdale to Mojave, Calif. Alex Robertson Co., contractor. E. C. Neal, spreadman at Lancaster, Calif., completion date 11-1-51.

Southern California Gas Co. and **Southern Counties Gas Co. of California.**—81 miles, 30-in., proposed, Whitewater to Desert Center, Calif.

Southern California Gas Co.—22 miles, 22-in., under way, Simi to Santa Clara River, Calif. Joe E. Young Pipeline Const. Co., contractor. Completion date 10-51.

Southern California Gas Co.—24 miles, 30-in., under way, Inglewood to San Ferdando Valley, California. Alex Robertson Co., contractor. Completion date 11-51.

Southern Natural Gas Co.—21 miles, 24-in., authorized, Perryville Station, La., to Boeuf River.

Southern Natural Gas Co.—14 miles, 24-in., authorized, Onward Station, Miss., to Big Sunflower River.

Southern Natural Gas Co.—14 miles, 14-in., authorized, Perryville Station, La., to Wilhite Gate.

Southern Natural Gas Co.—375 miles, 24-in., planned, Gwinville, Miss., to Atlanta, Ga.

Southern Natural Gas Co.—169 miles, proposed loops, Ouachita Parish, Louisiana, to Augusta, Ga.; 20 miles in Ouachita Parish, 33 miles in Ouachita and West Carroll parishes; 7 miles, Sharkey County, Mississippi, and 108 miles, 14-in., Bass Junction to Augusta, Ga.

Southern Union Gas Co.—15 miles, 20-in., authorized, Albuquerque main line; 18 miles 12¾-in., San Juan County, N. M.; 10 miles, 8⅝-in., authorized, Clovis to Portales, N. M., completion date 12-51.

Southwest Gas Corp., Ltd.—26 miles, proposed, from P. G. & E. line to Victorville, Calif.

Sunray Oil Corp.—133 miles, 3-30-in., under way, system for Snyder gasoline plant, Vaughan & Taylor Construction Co., contractor. D. D. Vaughn, spreadman.

Tennessee Gas Transmission Co.—[illegible] miles, 30-in., planned, first 150 miles of loops to be laid at Monroe, La., Greenville, Miss., Midland and Portland, Tenn.

Tennessee Gas Transmission Co.—[illegible]

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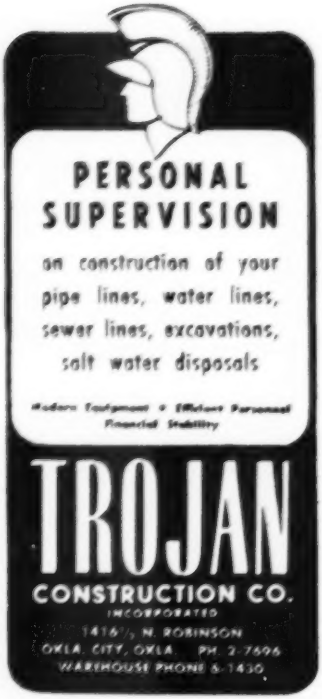

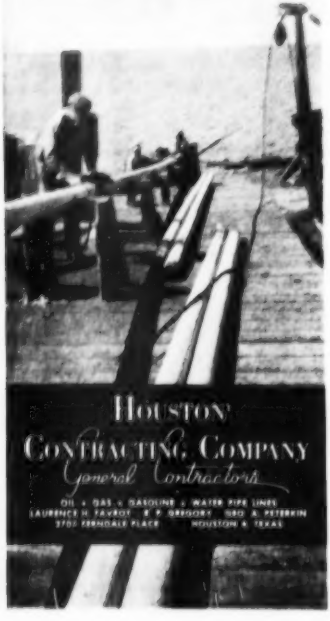
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miles, planned, looping on Buffalo and New England extensions.

Tennessee Gas Transmission Co. and Northeastern Gas Transmission Co.—173 miles, 24-in., under way, Albany, N. Y., near Wilmington, Boston area; **Mass. Oklahoma Contracting Co.**, contractor, Springfield, Mass., headquarters, Paul R. Halbert, manager; H. A. Wylie, spreadman at Pittsfield, Mass.; Aldrea Kilgore, spreadman at Westfield, Mass.; L. B. Rea, spreadman.

Tennessee Gas Transmission Co.—304 miles, 24-in., proposed, between Mercer, Pa., and Utica, N. Y.; 128 miles, proposed, loops; 200 miles, proposed, miscellaneous lateral lines.

Tennessee Gas Transmission Co.—138 miles, 30-in., under way, vicinity of Jones, La., on the north to near Cypress, Tex., on the south; Houston Contracting Co. Four spreads located as follows: North end work at Bastrop, Tex., W. H. Hayes and M. L. Thompson, superintendents; center section at Natchitoches, La., E. C. Norris and R. E. Thornton, superintendents; south end at Conroe, Tex., F. A. Silar, superintendent.

Tennessee Gas Transmission Co.—44 miles, 26 and 30-in., loops, contracted, South Texas Oklahoma Contracting Co., contractor, field office, Falfurrias, Tex., Panama Shiflett, superintendent.

Tennessee Gas Transmission Co.—136 miles, 24-in., under way, Hamburg to Onondaga-Madison County line, N. Y.; H. C. Price; Auburn and Warsaw, N. Y., field offices, G. A. Reutzel and R. K. Shivel, spreadmen.

Tennessee Gas Transmission Co.—120 miles, 24-in., under way, Hamburg to Hudson River; Bechtel Constructors, Inc.; Richfield Springs, N. Y., project office, R. L. Bowman and W. N. Molander, superintendents.

Tennessee Gas Transmission Corp.—419 miles, 26-30-in., authorized, loop line along presently authorized system.

The Texas Co.—27 miles, 8-in., authorized, Ventura to Filmore, Calif.

The Texas Co.—90 miles, 2-24-in., gas-gathering system, Holder Construction Co., Charley Andrus, spreadman at Snyder, Tex. Completion date 10-15-51.

Texas Eastern Transmission Corp.—791 miles, 30-in., under way, Kosciusko, Miss., to Connellsville, Pa.

Texas Eastern Transmission Corp.—163 miles, 30-in., under way, Kosciusko, Miss., to Florence, Ala.; Williams Bros.-Davis Co.; Kosciusko, Miss., field office, G. R. Hamilton, spreadman. Completion date 10-15-51.

Texas Eastern Transmission Corp.—50 miles, 30-in., under way, Ohio River to Vanceburg, Ky.; Trojan Construction Co., Inc., contractor, Charles Tillotson, spreadman at Winchester, Ky.

Texas Eastern Transmission Corp.—76 miles, 30-in., under way, Florence, Ala., to Columbia, Tenn.; Eastern Pipeline Contractors, Cliff Simmons, spreadman at Florence, Ala. Completion date 10-31-51.

Texas Eastern Transmission Corp.—79 miles, 30-in., under way, Cumberland River to Columbia, Ky.; Oman Construction Co., contractor, William Smith, superintendent and Floyd Hudnell, spreadman at Columbia, Ky.

Texas Eastern Transmission Corp.—80 mile, 30-in., under way, Columbia to Bonnesboro, Ky.; W. A. Haigh Co., contractor, Hubert Hutchins, spreadman at Campbellsville, Ky. Completion date 10-15-51.

Texas Eastern Transmission Corp.—100 miles, 30-in., under way, Kentucky River to Ohio River in northeastern Kentucky. Mahoney Const. Co., contractor. Henry Mogg, spreadman. Completion date 10-15-51.

Texas Eastern Transmission Corp.—73 miles, under way, Columbia, Tenn., to Cumberland River. H. B. Zachry Co. contractor; A. Vaughn, spreadman at Columbia, Tenn.; completion date 10-15-51.

Texas Gas Transmission Corp.—35 miles, 12-in., authorized, Slaughters, Ky., to Evansville, Ind.

Texas Gas Transmission Corp.—189 miles, 26-in., authorized, Acadia Parish to connection with existing facilities in Morehouse Parish.

Texas Gas Transmission Corp.—195 miles, 26-in., proposed, Gulf Coast region to southwestern Louisiana.

Texas Gas Transmission Corp.—425 miles, 26-in., proposed, looping from Bastrop, La. to Hardinsburg, Ky.

Texas Gas Transmission Corp.—181 miles, 26-in., under way, Bastrop to Eunice, La. Houston Contracting Co. North spread near Beekman, 45 miles south to Grayson, La., W. H. Hayes, supt.; center spread north side of Red River at Pineville, 60 miles north to Grayson, E. C. Norris, supt.; south spread, south side of Red River, 56 miles south to Tepetate field near Eunice, F. A. Silar, supt.

Texas Gas Transmission Corp.—300 miles, 26-in., proposed, Louisiana and Kentucky.

Texas-Illinois Natural Gas Pipeline Co.—1,200 miles, 30-in., under way, Corpus Christi area to Joliet, Ill.

Texas Illinois Natural Gas Pipe Line Corp., 58 miles, 30-in., under way, Joliet, Ill., to Volo Meter Station, Ray L. Smith & Son, Inc., contractor; field office, Aurora, Ill., R. M. Jones, spreadman.

Texas-Illinois Natural Gas Pipeline Co.—100 miles, 30-in., under way, Mississippi River to Effingham, Ill.; Midwestern Constructors, Inc., contractor of Schedule 12 John Work, superintendent; field office, Vandalia, Ill. Completion date 10-15-51.

Texas-Illinois Gas Pipe Line Corp.—60 miles, 30-in., contracted, Arkansas and Missouri; Bechtel Corp., V. L. Williams, supt. at Little Rock, Ark.

Texas Illinois Natural Gas Pipe Line Co.—106 miles, 30-in., under way, Texas-Arkansas state line to Malvern, Ark. Bechtel Corp., contractor. Completion date 10-15-51.

Texas Illinois Natural Gas Pipe Line Co.—130 miles, 30-in., under way, Malvern to Newsport, Ark. Bechtel Corp. Completion date 10-15-51.

Texas Illinois Natural Gas Pipe Line Co.—74 miles, 30-in., under way, Newport to Moark, Ark. Bechtel Corp., contractor. Completion date 10-15-51.

Texas-Illinois Gas Pipe Line Corp.—250 miles, 30-in., under way; Trinity River to Texarkana; H. C. Price, contractor. C. R. Shivel, spreadman at Carthage; C. H. Ice, spreadman at Nacogdoches.

Union Gas & Electric Co.—35 miles, 8-in., Bloomington to Harris, Ill. O. R. Burden, contractor. Floyd Lewis, spreadman at Bloomington, Ill. Fall completion date.

Union Oil Co. of California.—40 miles, 8-10-in., planned, San Joaquin Valley and Los Angeles Basin.

United Fuel Gas Co.—32 miles, 20-in., under way, Lanham to Broad Run, W. Va. H. L. Gentry Construction Co., contractor, Frank Morris, spreadman at Charleston, W. Va.

United Gas Pipe Line Corp.—315 miles, 24-30-in., contracted, Agua Dulce to near Goodrich, Tex. Oklahoma Contracting Co., contractor.

United Gas Pipe Line Corp.—53 miles, 24-in., authorized, Texas; 93 miles, 20-24-26-in., authorized, Houston, Beaumont, Orange, Tex.

United Gas Pipe Line Co.—50 miles, 16-in., authorized, Baldwin County, Alabama, southeasterly to Escambia County, Florida.

United Gas Pipe Line Co.—100 miles, 20-24-26-in., contracted, Near Houma to Franklin, La.; Associated Pipe Line Contractors, Inc.

United Gas Pipe Line Corp.—510 miles, 24-26-30-in., contracted, Agua Dulce, Tex., to Monroe, La.; 233 miles, 20-24-26-30-in., from Pure Oil Co.'s offshore platform Block 32 Eugene Island area to Jackson, Miss., comp. sta.; 60 miles, 12-16-20-in., from Lafayette comp. sta. and Weeks Island field to Franklin, La., to connect with above mentioned 30-in.; 59 miles, 30-in., Jackson comp. sta., Miss., to Texas Eastern Trans. Corp.; 124 miles, Sterlington comp. sta. near Monroe, La., to Jackson comp. sta., Miss.; 23 miles, 8-12-16-in., South Louisiana facilities; all contracted by Gulf Southern Contractors, a joint venture including Texas Louisiana Contractors; Oklahoma Contracting Co.; J. Ray McDermott and Morrison-Knudson. Inspection by Brown & Root, Inc.

United Gas Pipe Line Co.—30-in., contracted, Gonzales, La., to Kosciusko, Miss. Texas-Louisiana Contractors. Completion date 11-51.

United Gas Pipe Line Co.—24-in., contracted, Baxterville, La., to McComb; **Texas-**

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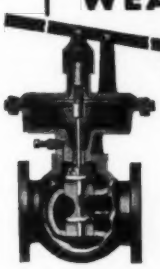

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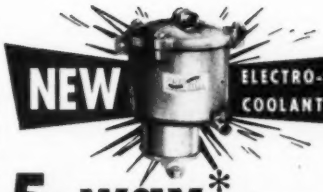

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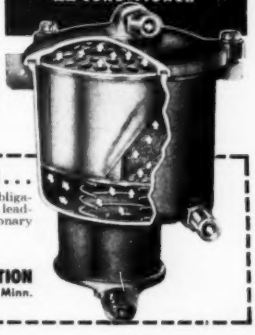

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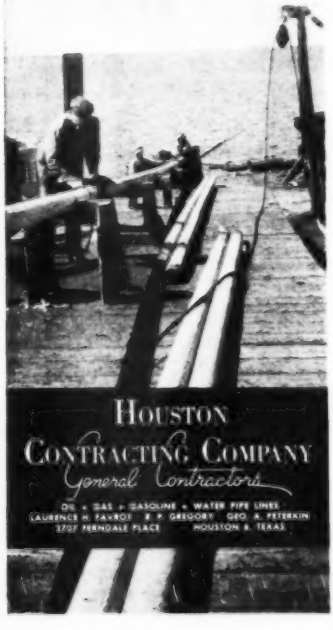
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miles, planned, looping on Buffalo and New England extensions.

Tennessee Gas Transmission Co. and Northeastern Gas Transmission Co.—175 miles, 24-in., under way, Albany, N. Y., near Wilmington (Boston area), Mass. Oklahoma Contracting Co., contractor, Springfield, Mass., headquarters, Paul R. Halbert, manager, H. A. Wylie, spreadman at Pittsfield, Mass., Aldress Kilgore, spreadman at Westfield, Mass. L. B. Rea, spreadman.

Tennessee Gas Transmission Co.—304 miles, 24-in., proposed, between Mercer, Pa., and Utica, N. Y.; 528 miles, proposed, loops; 200 miles, proposed, miscellaneous lateral lines.

Tennessee Gas Transmission Co.—158 miles, 30-in., under way, vicinity of Jones, La., on the north to near Cypress, Tex., on the south; Houston Contracting Co. Four spreads located as follows: North end work at Bastrop, Tex., W. H. Hayes and M. L. Thompson, superintendents; center section at Natchitoches, La., E. C. Norris and R. E. Thornton, superintendents; south end at Conroe, Tex., F. A. Silar, superintendent.

Tennessee Gas Transmission Co.—64 miles, 26 and 30-in., loops, contracted, South Texas. Oklahoma Contracting Co., contractor, field office, Falfurrias, Tex., Panama Shiflett, superintendent.

Tennessee Gas Transmission Co.—156 miles, 24-in., under way, Hamburg to Onondaga-Madison County line, N. Y.; H. C. Price; Auburn and Warsaw, N. Y., field offices, G. A. Reutzel and R. K. Shivel, spreadmen.

Tennessee Gas Transmission Co.—120 miles, 24-in., under way, Hamburg to Hudson River; Bechtel Constructors, Inc.; Richfield Springs, N. Y., project office, R. L. Bowman and W. N. Molander, superintendents.

Tennessee Gas Transmission Corp.—419 miles, 26-30-in., authorized, loop line along presently authorized system.

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The Texas Co.—90 miles, 2-24-in., gas-gathering system, Holder Construction Co., Charley Andrus, spreadman at Snyder, Tex. Completion date 10-15-51.

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Texas Eastern Transmission Corp.—163 miles, 30-in., under way, Kosciusko, Miss., to Florence, Ala.; Williams Bros.-Davis Co.; Kosciusko, Miss., field office, G. R. Hamilton, spreadman. Completion date 10-15-51.

Texas Eastern Transmission Corp.—50 miles, 30-in., under way, Ohio River to Vanceburg, Ky. Trojan Construction Co., Inc., contractor. Charles Tillotson, spreadman at Winchester, Ky.

Texas Eastern Transmission Corp.—76 miles, 30-in., under way, Florence, Ala., to Columbia, Tenn. Eastern Pipeline Contractors, Cliff Simmons, spreadman at Florence, Ala. Completion date 10-31-51.

Texas Eastern Transmission Corp.—79 miles, 30-in., under way, Cumberland River to Columbia, Ky. Oman Construction Co., contractor. William Smith, superintendent and Floyd Hudnell, spreadman at Columbia, Ky.

Texas Eastern Transmission Corp.—80 mile, 30-in., under way, Columbia to Boonesboro, Ky. N. A. Saigh Co., contractor. Hubert Hutchins, spreadman at Campbellsville, Ky. Completion date 10-15-51.

Texas Eastern Transmission Corp.—100 miles, 30-in., under way, Kentucky River to Ohio River in northeastern Kentucky. Mahoney Const. Co., contractor. Henry Mogg, spreadman. Completion date 10-15-51.

Texas Eastern Transmission Corp.—73 miles, under way, Columbia, Tenn. to Cumberland River. H. B. Zachry Co. contractor; A. Vaughn, spreadman at Columbia, Tenn.; completion date 10-15-51.

Texas Gas Transmission Corp.—35 miles, 12-in., authorized, Slaughters, Ky., to Evansville, Ind.

Texas Gas Transmission Corp.—189 miles, 26-in., authorized, Acadia Parish to connection with existing facilities in Morehouse Parish.

Texas Gas Transmission Corp.—195 miles, 26-in., proposed, Gulf Coast region to southwestern Louisiana.

Texas Gas Transmission Corp.—425 miles 26-in., proposed, looping from Bastrop, La to Hardinsburg, Ky.

Texas Gas Transmission Corp.—181 miles 26-in., under way, Bastrop to Eunice, La. Houston Contracting Co. (North spread near Beekman, 65 miles south to Grayson, La., W. H. Hayes, supt.; center spread north side of Red River at Pineville, 60 miles north to Grayson, E. C. Norris, supt.; south spread, south side of Red River, 56 miles south to Tepetate field near Eunice. F. A. Silar, supt.).

Texas Gas Transmission Corp.—360 miles 26-in., proposed, Louisiana and Kentucky

Texas-Illinois Natural Gas Pipeline Co.—1,300 miles 30-in., under way, Corpus Christi area to Joliet, Ill.

Texas Illinois Natural Gas Pipe Line Corp. 58 miles, 20-in., under way, Joliet, Ill., to Volo Meter Station, Ray L. Smith & Son, Inc., contractor; field office, Aurora, Ill.; R. M. Jones, spreadman.

Texas-Illinois Natural Gas Pipeline Co.—100 miles, 30-in., under way, Mississippi River to Effingham, Ill.; Midwestern Constructors, Inc., contractor of Schedule 11 John Work, superintendent; field office, Vandalia, Ill. Completion date 10-15-51.

Texas-Illinois Gas Pipe Line Corp.—405 miles, 30-in., contracted, Arkansas and Missouri; Bechtel Corp. V. L. Williams, supt at Little Rock, Ark.

Texas Illinois Natural Gas Pipe Line Co. 106 miles, 30-in., under way, Texas-Arkansas state line to Malvern, Ark. Bechtel Corp., contractor. Completion date 10-15-51.

Texas Illinois Natural Gas Pipe Line Co.—130 miles, 30-in., under way, Malvern to Newport, Ark. Bechtel Corp. Completion date 10-15-51.

Texas Illinois Natural Gas Pipe Line Co.—74 miles, 30-in., under way, Newport to Moark, Ark. Bechtel Corp., contractor. Completion date 10-15-51.

Texas-Illinois Gas Pipe Line Corp.—306 miles, 30-in., under way; Trinity River to Texarkana; H. C. Price, contractor. C. E. Shivel, spreadman at Carthage; C. R. Ice, spreadman at Nacogdoches.

Union Gas & Electric Co.—35 miles, 8-in., Bloomington to Harris, Ill. O. R. Burden, contractor. Floyd Lewis, spreadman at Bloomington, Ill., Fall completion date.

Union Oil Co. of California.—40 miles, 8-10-in., planned, San Joaquin Valley and Los Angeles Basin.

United Fuel Gas Co.—32 miles, 20-in., under way, Lanham to Broad Run, W. Va. H. L. Gentry Construction Co., contractor, Frank Morris, spreadman at Charleston, W. Va.

United Gas Pipe Line Corp.—315 miles, 24-30-in., contracted, Agua Dulce to near Goodrich, Tex. Oklahoma Contracting Co., contractor.

United Gas Pipe Line Corp.—53 miles, 24-in., authorized, Texas; 93 miles, 20-24-26-in., authorized, Houston, Beaumont, Orange, Tex.

United Gas Pipe Line Co.—50 miles, 16-in., authorized, Baldwin County, Alabama, southeasterly to Escambia County, Florida.

United Gas Pipe Line Co.—100 miles, 20-24-26-in., contracted, Near Houma to Franklin, La.; Associated Pipe Line Contractors, Inc.

United Gas Pipe Line Corp.—510 miles, 24-26-30-in., contracted, Agua Dulce, Tex., to Monroe, La.; 233 miles, 20-24-26-30-in., from Pure Oil Co.'s offshore platform Block 32 Eugene Island area to Jackson, Miss., comp. sta.; 60 miles, 12-16-20-in., from Lafayette comp. sta. and Weeks Island field to Franklin, La., to connect with above mentioned 30-in.; 59 miles, 30-in., Jackson comp. sta., Miss., to Texas Eastern Trans. Corp.; 124 miles, Sterlington comp. sta. near Monroe, La., to Jackson comp. sta., Miss.; 23 miles, 8-12-16-in., South Louisiana facilities; all contracted by Gulf Southern Contractors, a joint venture including Texas Louisiana Contractors; Oklahoma Contracting Co.; J. Ray McDermott and Morrison-Knudson. Inspection by Brown & Root, Inc.

United Gas Pipe Line Co.—30-in., contracted, Gonzales, La., to Kosciusko, Miss. Texas-Louisiana Contractors. Completion date 11-51.

United Gas Pipe Line Co.—24-in., contracted, Baxterville, La., to McComb; Texas-

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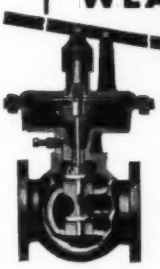

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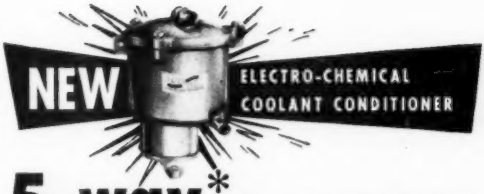

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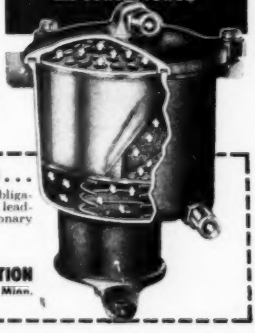

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Louisiana Contractors. Completion date 11-51.

U. S. Army Engineers.—190 miles, 6⅝-in., under way, Searsport to Limestone, Me. Associated Pipe Line Contractors, Inc. Completion date 10-15-51.

U.S.E.D.—18 miles, 8⅝-in., contracted, Norwalk to Long Beach, Calif. J. E. Young Pipeline Contractor, Inc.

Utah Natural Gas Co.—360 miles, 22-in. proposed, San Juan Basin area to Salt Lake Utah.

Virginia Natural Gas Co.—153 miles, Buckingham to Richmond and Portsmouth, Va.

Westcoast Transmission Co., Ltd.—1,408 miles, 30-in., planned, northern Alberta to Vancouver, B. C., and northern California.

Western Kentucky Gas Co.—2 to 4-in., under way, additions to present system; Modern Welding Co., Inc., contractor.

Western Pipe Lines.—1,200 miles, 22-in. planned, Southern Alberta to Duluth, Minn.

West Texas Gas Co.—27 miles, 10-in., authorized, Lubbock to Abernathy, Tex.

Foreign Crude-Oil Pipe Lines—Planned and Under Way

Alberta Pacific Oil Pipe Line Co. (Brokaw, Dixon, McKee).—970 miles, 16-in. proposed, Edmonton south to Kingsgate, B. C., to Washington to Vancouver, B. C.

Cia. de Petroleo Ganso Azul, Ltd.—48 miles, 4-in., planned, Ganso Azul field to Yacalpa on upper Ucayali River, Peru.

Condor S.P.A. (Shell).—80 miles, planned, Trecca to Rho, near Milan, Italy.

Direccion General de Yacimientos Petroliferos Fiscales.—409 miles, under way, Plaza Huincul to Bahia Blanca, Argentina.

Independent Pipe Line Co.—721 miles, 16-18-22-in., proposed, Edmonton to Vancouver. Spreads as follows: 185 miles of 22-in.; 391 miles, 20-in.; 95 miles, 16-in.; and 30 miles, 18-in.

Iraq Petroleum Co., Ltd.—556 miles, 30-32-in., under way, Kirkuk, Iraq, to Banias, Syria, 1952; Bechtel-Kirkuk contractor.

Middle East Pipelines, Ltd.—800 miles, 36-in., planned, Iran to a Levantine port.

Petroleos Mexicanos.—145 miles, 12-in., considered, 18 de Marzo field via Reynosa to Monterrey, Mexico.

Petroleos Mexicanos.—100 miles, planned, Isthmus of Tehuantepec, Jose Colomo to El Plan field, Minatitlan.

Shell Caribbean Petroleum Co.—160 miles, 30-in., under way; Palmarejo to terminals in the Paraguana Peninsula (Carden and Las Piedras, Venezuela), 4-52. Land sections contracted by Williams Brothers, de Venezuela, S. A., Charles P. Williams, manager, Marvin E. Jones, superintendent. Water crossings contracted by Mahoney Contracting Co.

Trans-Mountain Oil Pipe Line Co.—718 miles, proposed, Edmonton, Alta., to Vancouver, B. C. Canadian Bechtel, Ltd., contractor. Completion date 1952.

Winnipeg Pipe Line Co., Ltd.—75 miles, 10-in., under way, Gretna to Winnipeg, Manitoba; Sparling-Fowler Co., Ltd.

Foreign Products Pipe Lines—Planned and Under Way

Colombia Ministry of Petroleum.—90 miles, 6-in., planned, Puerto Berrio to La Dorada, Colombia.

Colombia Ministry of Petroleum.—113 miles, 6-in., contracted, Puerto Berrio to Acededo near Medellin, Colombia. Carolina Construction Co.

Colombian Ministry of Petroleum.—73 miles, 4-in., planned, Buena Ventura to Cali, Colombia.

Empresa de Ferrocarriles Ecuatorianos.—50 miles, 4-in., under way, Guayaquil to Palmira, Ecuador. J. A. Jones, contractor.

Estrada de Ferro Santos a Jundial.—32 miles, 18-in., under way, Santos to Sao Paulo, Brazil (fuel oil line); Techint, contractor. Completion date 12-51.

Governments of Southern Rhodesia and Portuguese East Africa.—200 miles, considered, Beria, Portuguese Mozambique to Umtali, Southern Rhodesia.

Imperial Oil Co., Ltd.—195 miles, 10-12-in., planned, Sarnia via London, Hamilton to Toronto, Ont., Canada.

Petrocongo (Sub. Cie. Financiere Belge des Petroles, S. A.).—235 miles, considered, Ango-Ango to Leopoldville, Belgian Congo.

Petroleos Mexicanos.—155 miles, 10-in., under way, Minatitlan to Salina Cruz, Mexico.

Societe des Transports Petroliers par Pipe Line.—140 miles, 10-in., under way, Le Havre to Paris, France. Entrepose, contractor. Completion date 1952.

State of Cundinamarca, Colombia.—120 miles, 6-in., Puerto Salgar, to Bogota, Colombia; Williams Brothers Corp., David Louthen, manager, Bogota.

Trans-Northern Pipe Line Co.—400 miles, proposed, Hamilton, Ont., to Toronto, Ont., to Montreal, Que., Canada.

Foreign Natural-Gas Pipe Lines—Planned and Under Way

Azienda Generale Italiana Petroli.—110 miles, 12-14-16-in., planned, Cortemaggiore to Genoa.

Azienda Generale Italiana Petroli.—110 miles, planned, Cortemaggiore to Bologna.

Azienda General Italiana Petroli.—140 miles, 14-16-in., under way, Cortemaggiore to Torino. Completion date 1951.

Canadian Western Natural Gas Co., Ltd.—27 miles, 8-in., under way, Jumping Pound to Exshaw, Alberta. Company crews. Completion date 10-51; 22 miles, 6-in., under way, Exshaw to Banff. Company crews. Completion date 10-51.

Canadian Delhi Oil Co. (Subsidiary Delhi Oil Co.).—2,132 miles, proposed, Alberta, Toronto, Montreal.

Direccion General del Gas del Estado.—310 miles, 8-in., under way, Plaza Huincul to Neuquen, Argentina, to the vicinity of General Conesa, Argentina.

Northwest Natural Gas Co.—950 miles, 24-in., planned, Alberta fields to Vancouver, B. C., Seattle, Wash., and Portland, Ore.

Northwestern Utilities, Ltd.—35 miles, 16-in., authorized, Viking to Shonts, Alberta.

Petroleos Mexicanos.—205 miles, 16-in., considered, Monterrey to Torreon, Mexico.

Petroleos Mexicanos.—260 miles, 20-in., under way, Monterrey to Tampico and Poza Rica, Mexico.

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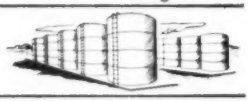

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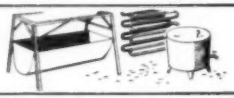

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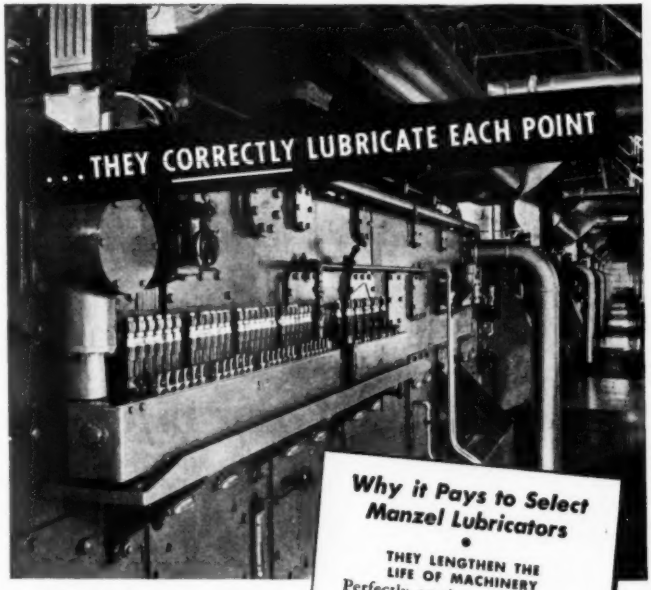

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PIPE LINES

Big Platte Crude Line to Be Completed in Mid-1952

INDEPENDENCE, Kans.—Platte Pipe Line Co.'s big $60,000,000 crude line from Worland, Wyo., to Wood River, Ill., will go into operation about the middle of next summer, according to Millard K. Neptune, president.

Enough pipe to finish the line has been promised by the Petroleum Administration for Defense. It will be delivered during the fourth quarter of this year, the first and second quarters of next year in sufficient quantity to keep two spreads working on the line, Neptune said. Everything else needed to complete the project already is on hand.

Meanwhile the two spreads still working were rapidly running out of pipe. R. H. Fulton & Co.'s spread operating 65 miles east of Casper, Wyo., will use up its pipe late this week and will be shut down 2 weeks before more arrives.

O. R. Burden Construction Corp., working east of Salisbury, Mo., has already exhausted its supply of pipe and has suspended operations except for a part of a spread working on an 8-mile section of line just west of the Mississippi River.

The 1,100-mile line, a joint venture of five oil companies, will provide a much-needed outlet for Rocky Mountain crude when completed. Sinclair Pipe Line Co., operator, is joined in the project by Continental Oil Co., British-American Oil Producing Co., Ohio Oil Co., and Pure Oil Co.

Phillips' Products-System Expansion Moving Ahead

BARTLESVILLE, Okla.—Progress on six segments of an expansion program designed to increase capacity of Phillips Pipe Line Co.'s Phillips, Tex.-East Chicago, Ind., products system by 30,000 bbl. per day was announced here this week.

The expansion will step up capacity of the system to 115,000 bbl. per day. On the section of line from Borger, Tex., to Buffalo, Okla., Arey-Phillips Construction Co. is laying 46 miles of 12-in. line. Completion date is October 1951.

The segment from Buffalo, Okla., to Wichita is scheduled for completion by November 1951. G. G. Griffis Construction Co., is laying 48 miles of 12-in. pipe line. Authorized but not yet contracted is 69 miles of 12-in. line from Wichita to Paola, Kans.

Contract has not been let for the segment authorized from Paola to East St. Louis, Ill. This leg comprises 137 miles of 10-in. line.

Brown-Lite Co. is scheduled to complete by November 1951 101 miles of 8-in. line from East St. Louis to Decatur, Ill.

Somerville Construction Co. will complete 74 miles of 8-in. line by December 1951 on the segment extending from Decatur to East Chicago. Pipe was delivered last week for the East St. Louis-East Chicago project.

Service Lets Contracts for New Texas Gathering Lines

Service Pipe Line Co. has let contracts to two Texas contractors for construction of twin 15-mile, 6-in. pipe lines connecting two West Texas oil pools with the company's Jud-Bowie, Tex., trunk line now nearing completion.

C. M. Scott, general manager, Tulsa, said Jim J. McCormick Co., Wichita Falls, Tex., will build the line to serve production from North Knox City pool. Gaasch Construction Co., Brownfield, Tex., will connect South Haskell pool.

Construction on the 123-mile, 10-in. line from Jud to Bowie is now about 90 per cent completed, Scott said. The completed portion of the line was being hydrostatically tested last week.

Vickers Plans Construction Of Products Line in Kansas

WICHITA.—Vickers Petroleum Co., Inc., will begin construction in the fourth quarter of a 15-mile, 8⅝-in. products pipe line from its refinery at Potwin, Kans., to a connection with Great Lakes Pipe Line Co.'s terminal facilities at El Dorado, Kans.

Pipe for the line is scheduled for fourth-quarter delivery, and pump, coating, and miscellaneous material and equipment are already on hand at Potwin, according to J. B. Smith, vice president.

El Paso to Build Two New Texas Compressor Stations

WASHINGTON.—El Paso Natural Gas Co., El Paso, Tex., has received the green light from the Federal Power Commission to build a 1,980-hp. compressor station near Shell Oil Co.'s TXL plant in Ector County, Texas.

The new station will be used to transport an additional 17,800,000 cu. ft. of natural gas per day from Shell's plant to El Paso's Keystone plant in Winkler County, Texas, through two

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existing lines. Estimated cost is $453,000.

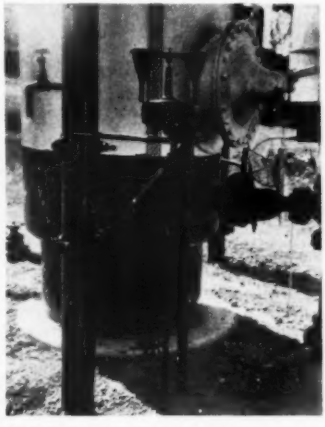
The commission at the same time found that El Paso will not need FPC authorization to build a 1,100-hp. compressor station near Phillips Petroleum Co.'s Seminole natural-gasoline plant in Gaines County.

The station will increase capacity of the pipe line between Phillips' plant and Columbian Carbon Co.'s plant from 18,300,000 to 28,200,000 cu. ft. per day. The line is owned by Columbian, and the entire volume of gas sent through the line will be consumed by Columbian. This expansion is estimated to cost $291,000.

Pipe-Line Briefs

Phillips Petroleum Co. has started construction of a products pipe line to extend 28 miles from Sweeny to Freeport, Tex. The line will be of 12-in. Completion is expected by March 1952.

Construction has been started by Phillips Petroleum Co. on a natural-gas pipe line from Chocolate Bayou field in Brazoria County to Blue Lake in Wharton County, Texas. The project, comprising 20 miles of 8-in., is scheduled for completion by October 1951.



CHORE EASED.—One of the chores connected with field inspection of crude oil has been reduced to a comparatively easy operation at a lease in Castaic Junction field in California. A turbine-driven centrifuge for b.s. and w. measurements at the tank battery has been permanently mounted on a support attached to a vertical portion of the gas line from the battery's separator. Low-pressure gas is used to drive the turbine. A valve conveniently located permits throttling of the inlet gas to obtain desired speeds on the centrifuge. Exhaust gas from the turbine is removed via a small-diameter pipe. The steel support can be attached to the vertical pipe with clamps at any desired height. The general arrangement provides a rigid installation which is relatively free from vibration.

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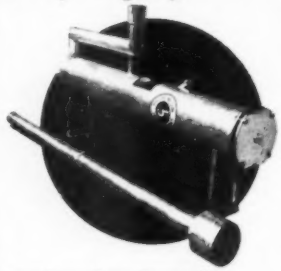

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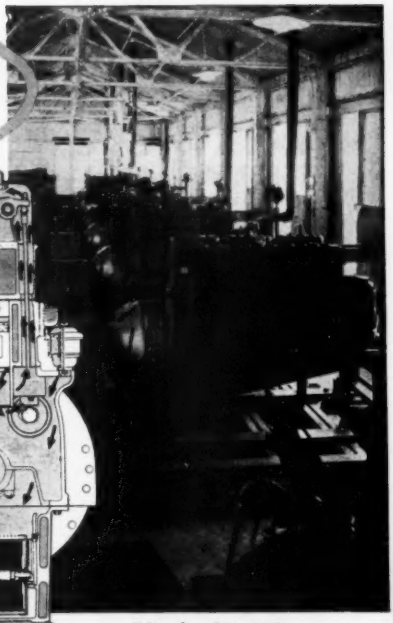

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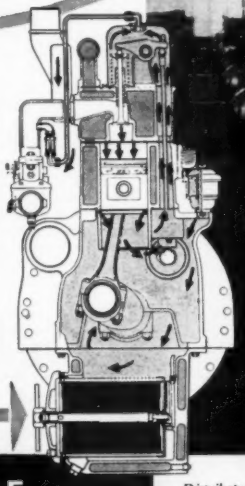

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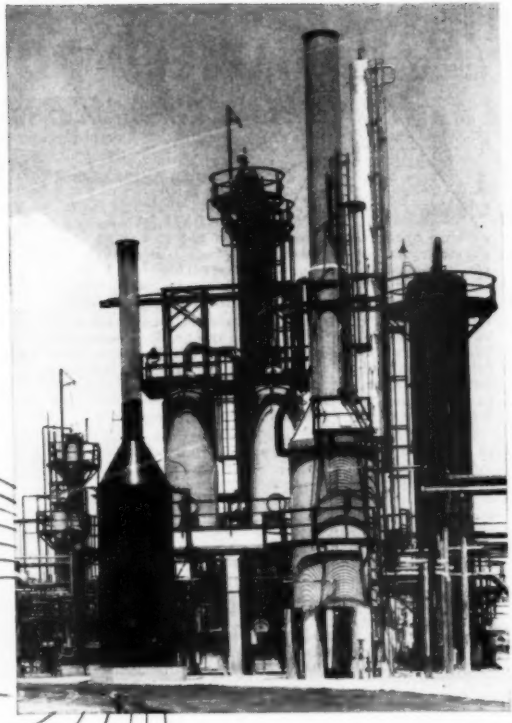

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REFINING

Biggest Residuum Stripper Operating at Richmond Plant

SAN FRANCISCO. — The world's largest residuum stripper, capable of handling 50,000 bbl. of heavy fuel oil daily, has been placed in operation at Standard Oil Co. of California refinery near here.

The new vacuum unit is part of the company's program designed to relieve overproduction of heavy fuels and to increase the yield of high-octane gasolines. It will process heavy residues from other refining processes in the Richmond plant to prepare charge stock for a revamped catalytic cracker.

This unit, originally a T.C.C. unit of 32,500-bbl. capacity, is being converted to a modified Houdriflow cat cracker of similar capacity. The unit's coke-burning capacity is being increased from 150 tons per hour to 500 tons per hour, enabling it to better handle heavy feed stocks.

Shell Completes Expansion Of Big Willbridge Terminal

PORTLAND.—Shell Oil Co. has completed a 3-year, multimillion-dollar expansion of its Willbridge terminal on the Willamette River in the northwestern part of this city.

The expansion has resulted in enlargement of petroleum-processing facilities and an increase of more than one-third in storage capacity to a total of about 1,200,000 bbl.

The terminal, Shell's second largest in this country, distributes around 24,000 bbl. of products daily in Oregon, Washington, and Idaho. Products include various grades of lubricating oils and 21 different paving grades of asphalts and road oils.

The Willbridge installation receives refined gasolines and petroleum stocks from Shell refineries by ocean-going tanker and redistributes them by tank truck, tank car, and barge to inland depots.

Among the enlarged installations is a lubricating-oil processing plant where base stocks from Martinez are blended with chemicals and additives into finished lubes. Asphalts are processed in a vacuum-fractionation column and leave the plant in specially insulated tank trucks and tank cars.

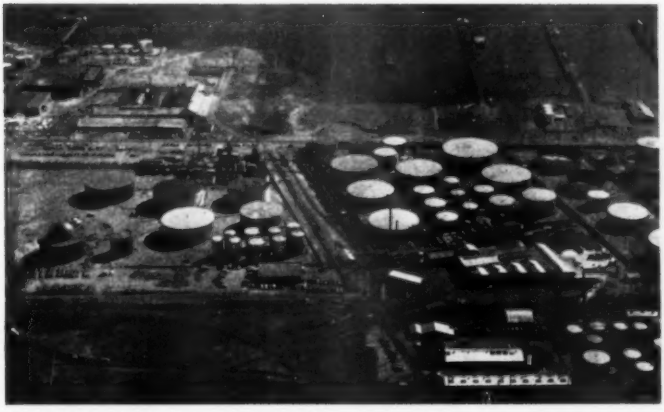
A.P.I. Committee Studies New Lube-Oil Designation

ATLANTIC CITY.—The lubrication committee of the American Petroleum Institute, meeting here last week, considered again the matter of recommending service classifications for crank-case oil.

An interim report of the crank-case-designation panel outlined three suggested classifications for lubes for gasoline and other spark-ignition engines. Discussion of the three classes and the service definitions outlined for each revealed that there still existed some differences of opinion.

Hence, the panel's tentative definitions will be circulated to all members of the committee, and further action will await the group's next meeting in Chicago in November.

The suggested definitions, as presently drawn up, call for three motor-oil types for spark-ignition engines.



BIGGER AND BETTER.—More than 1,000,000 gal. of gasoline and other petroleum products are now leaving Shell Oil Co.'s modernized and expanded Willbridge Terminal in Portland every day for redistribution throughout Oregon, eastern Washington, and Idaho.

Over 85% of the torque wrenches used in industry are
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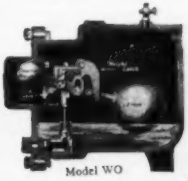

Top trap for press. to 650 lbs.; bottom, to 1500.

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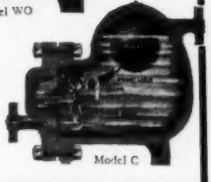
Both types widely used for discharging gasoline, water and oil.



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Proposed definitions of service for two oil types for diesel service are not expected to be altered and were not discussed.

The proposal for three service classifications instead of two has been developed for two reasons. Some oil companies believe that there are conditions of service for which current premium-type oils were satisfactory, whereas regular-type oils were not. This is contrary to the implication of the proposal which has been under consideration by the lubrication committee. Also, important manufacturers have not been willing to recommend the type of oil called for to meet requirements of Service Class MS and did not wish to accept all the various types of oils which might be recommended under Service Class MO. Consequently they felt that the present proposal was not acceptable.

Refining Briefs

Deep Rock Oil Corp. is starting construction immediately on a new packaging plant for motor oils and greases at its Cushing, Okla., refinery, according to W. J. Carthaus, vice president of the company's manufacturing and research division. The new plant will begin operation late this year. Contract for construction is held by the chemical-plants division of Blaw-Knox Construction Co.

Shell Oil Co. and its subsidiary, Shell Chemical Corp., announced last week development of new aviation-gasoline and fuel-oil additives. The former is claimed by Shell virtually to eliminate spark-plug fouling due to gradually-accumulating current-conducting deposits. It merely changes the nature of the deposit so that it does not conduct electricity. The fuel-oil additive, Ionad 17, greatly reduces filter-screen clogging in domestic fuel-oil burners, Shell said. Marketing of the product was held up until field tests proved its effectiveness because of the revolutionary nature of incorporating an additive into fuel oil.

Arrangements for Union Oil Co. to test oil shales from Sao Paulo, Brazil, in its pilot shale-oil plant at Wilmington, Calif., were concluded at Los Angeles last week. Some 450 tons of these shales are to be shipped here so that their oil content can be determined. Col. Gabriel Fonseca headed the Brazilian mission which made the arrangements, assisted by Albino de Souza, vice president of the National Petroleum Council.

Formula 3 in No. 86 of Refiners Notebook series on "Cleanout Openings for Oil-Storage Tanks" (The Oil and Gas Journal, August 30, page 95) shows $(H)^{1/2}$ as a denominator. This value is a part of the numerator of the fraction. Formula 3 correctly reads:

$$t_b = [w(H)^{1/2}/1{,}150] + (F_b/24{,}000\ b)$$

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NATURAL GAS

Imports Conflict

Gas company, coal clique in hot battle before FPC

BILLINGS, Mont.—Bringing natural gas from Canada would hurt the coal business in the United States, representatives of the coal interests and coal miners insisted at a hearing before the Federal Power Commission here last week.

Counsel for the United Mine Workers of America and the National Coal Association drove home this point at the FPC hearing over applications of the Montana Power Co. for permission to import natural gas for the first time into the United States and for FPC authority to build the necessary pipe-line connection on this side of the border.

As Hearing Examiner Marvin Farrington sided with opposition attorneys in asking Montana Power to clarify its application, the power company warned that it must have natural gas from Canada, if it is to continue serving the state's defense-essential mining industry.

R. H. Glover, general counsel for Montana Power, said the utility would confine hearing argument to importation of the 43.8 billion cubic feet approved for export by the Alberta legislature. That amount, strictly for defense needs of Anaconda Copper Mining Co., must be removed by April 7, 1956, and no more than 10 billion cubic feet may be withdrawn in any one year from the Pakowki Lake area in southeastern Alberta.

To avoid further delaying argument, Glover said Montana Power proposes to operate the necessary 52-mile pipe-line connection in Montana, instead of a company subsidiary, Western Gas Co., as originally proposed.

OPS Determined to Hold Prices at Present Levels

WASHINGTON.—The Office of Price Stabilization is determined to hold natural-gas prices at their present levels, from well to consumer.

This became apparent last week when, on the heels of a denial of the appeal of Stanolind Oil & Gas Co. and Continental Oil Co. for a 2-cent increase in the price of Woodlawn-field gas, OPS asked leave to intervene in an application for higher rates filed with the Federal Power Commission by Hope Natural Gas Co.

In its petition, OPS asserted that if the commission approved the increase, which it estimated would amount to 16 per cent, its public-utility customers "probably" would apply to the state commissions of Ohio, Pennsylvania, New York, and West Virginia for permission to pass the increase on to more than 1,000,000 consumers.

OPS said that intervention is called for because a large segment of the industrial and domestic economy would be affected by the commission's action.

Well-Head Prices in Texas Panhandle Up ½ Cent in Year

AUSTIN. — Well-head prices for natural gas in the Texas Panhandle during the past year rose almost ½ cent per M.c.f., according to the Texas Railroad Commission.

The commission disclosed that market price for sweet gas at 14.65 psi. averaged 4.3348 cents per M.c.f. The price was 3.9083 cents a year ago.

In pricing sour gas, the commission said a discount of ½ cent per M.c.f. should be figured since that is about the cost of desulfurization. The commission cannot fix prices but is required by Texas law to decide at least once a year what is a fair market price in Panhandle field.

Natural Gasoline

Stripper on Stream

T.G.T. operating initial units of Gabe, Ky., plant

GABE, Ky.—Tennessee Gas Transmission Co. has completed construction of initial units for its $10,000,000 stripping plant near here, and operations have been started on a small scale.

Natural-gas feed for the new plant will pass through extraction units on its way through Tennessee's pipe-line system to the Appalachian and eastern areas. Stripped gas will be returned to the system with no appreciable reduction in quality.

The plant will process about 750,000,000 cu. ft. of gas daily when in full operation and will produce about 380,000 gal. of liquid hydrocarbons. It will extract substantially all propane, butane, hexanes, and heavier hydrocarbons present plus about 16 per cent of the ethane.

More units.—Additional units will be completed at the Gabe plant later this year and also at the new $17,000,000 Mathieson Hydrocarbon Chemical Corp. plant near Brandenburg, Ky., on the Ohio River, which will take the entire liquid-hydrocarbon output of Tennessee's stripping installation. The Mathieson plant, also in partial operation now, will receive the stream through a 58-mile, 8-in. pipe line. The steam will be fractionated into L.P.G. and natural gasoline at this plant which is at present receiving a limited amount of ethane, propane, and heavier hydrocarbons from Tennessee's stripping plant.

On completion of both plants late this year, Tennessee will increase ethane content of the liquid stream to design quantity. The Mathieson chemical plant will crack ethane into ethylene and several other gases. Products in addition to L.P.G. will include a variety of chemicals.

Shell Exploring Salt Beds For Possible L.P.G. Storage

ELK CITY, Okla.—Shell Oil Co. is investigating the possibility of storing propane in shallow salt beds in Elk City field in Beckham County, south of this city.

Operator is coring continuously at the salt level to determine thickness and purity of salt deposits at 5 J. I. Long, C NW SW 15-10n-21w; currently core head is rotating below 1,420 ft. Thickest salt bed logged to date in this well is 13 ft.

Shell is considering underground storage of surplus summer output of propane production from the Elk City plant. Propane has been stored in underground salt reservoirs in Keystone field of Winkler County, the big Scurry oil field of Scurry County, Benedum field of Reagan and Upton counties, and other areas.

Phillips Drills Permian Salt For Possible L.P.G. Storage

BORGER, Tex.—Two shallow wells are being drilled by Phillips Petroleum Co. 4 miles north of this city for possible future underground storage of L.P.G. Situated 2 miles west of the Borger natural-gasoline plant, these wells will store surplus plant products at a depth of about 1,500 ft. in Permian salt formation.

Operators may use bottom-hole pump for pumping propane instead of the conventional method of injection of salt water through the tubing and producing L. P. G. through the casing-tubing annulus.

Union Expands Plant

LOS ANGELES.—Union Oil Co. recently completed installation of additional compressors and gas-gathering facilities as well as the modernization of existing facilities at its Del Valle natural-gasoline plant 35 miles northwest of here.

The program has increased the plant's production from 43,000 to 53,000 gal. daily. Union purchased the plant last December from Havenstrite Oil Co.

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Among the Drilling Contractors

Number of Active Rigs Still Breaking Records

The number of operating rotary rigs in the United States and western Canada continues to mount each week to successively high all-time records. At latest report (week ended September 10), the number totaled 2,940, an increase of 13 rigs over the previous week, 59 more than a month ago, and 624 more than at the same time a year ago. Operating rigs in the United States alone totaled 2,783 on the latest report with 157 running in western Canada. Additional rigs continue to be moved into the West Texas-New Mexico area where the number now operating has reached a total of 996.

ACTIVE ROTARY RIGS*
(United States and Western Canada)

Area—	Week ended 9-10-51	Change week ended 9-3-51	Change week ended 9-11-50
Gulf Coast	608	+ 7	+ 82
W. Tex.-N. M.	996	+ 9	+226
Ark.-N. La.-E. Tex.	175	+ 9	+ 39
Oklahoma	305	— 6	+ 27
Kansas-S. Nebraska	179	—13	+ 47
Illinois-Eastern	149	+10	+ 33
Rocky Mountains	187	— 4	+ 61
Pacific Coast	184	+ 1	+ 48
Total United States	2,783	+13	+563
Western Canada	157	0	+ 61
Total	2,940	+13	+624

*Courtesy Hughes Tool Co. Trends in drilling activity in the United States and the West Texas-New Mexico and Oklahoma-Kansas areas are shown on pages 380 and 381.

Beardmore Expands

Beardmore Drilling Co., Wichita, has acquired the holdings of O. A. Sutton Corp., including all drilling equipment, as well as all producing and non-producing properties. With consummation of the deal, H. K. Beardmore, Sr., co-owner, is returning to active participation in the operation of the firm with his son, Heber Beardmore, Jr.

Kern & Trimble Drilling Co. is moving a rig to the new northeast extension area of the Bear Creek field, Union County, Arkansas, where it will drill for Herbert Herff and Joseph Lewis at 1 Moon, SW SW NW 4-16s-17w, which offsets the extension area's discovery well, McAlester Fuel Co. 1-B Southern, now being completed in the field's Travis Peak pay around 4,010 ft. **Carl Brooks,** Oil City, La., also has a contract with the above operators for a Travis Peak well to be drilled in the Bear Creek field proper. That well will be 1-A Smith, NW NW NW 16-16s-17w.

Curtis-West Drilling Co., Stuttgart, Ark., is undertaking a rank wildcat test for its own account at 1 Day, NW NW SW 1-1n-5w, 3 miles northeast of Tollville, in Prairie County, central Arkansas. Hole is projected to 3,000 ft.

Teepee Drilling Co., Oklahoma City, has a rig working on a rank wildcat being drilled for Moon Exploration

Although overshadowed by the activity in proving up the more recently discovered deeper producing horizons in the area, development of the original shallower sands of the Velma field, Stephens County, continues to furnish work for drilling contractors. Shown in the picture is a typical shallow drilling operation in the field. Contractor is Rodgers-Briscoe Drilling Co., drilling for Skelly Oil Co. at a location "twinning" a deeper sand well.

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Exploration Drilling Co., Casper, Wyo., has a Tensleep exploratory test under way for British American Oil Producing Co. at 1 Horne Brothers, NW SW NW 16-21n-78w, 4 miles northeast of the Medicine Bow field, Carbon County, Wyoming.

Cooper-Herring Drilling Co., Tyler, Tex., is starting a projected 4,800-ft. test for Iowa-Payne Oil Co. at 1 Larkins and associates in the Juan N. Villareal Survey, 10 miles northwest of Athens, Henderson County, East Texas.

H. & H. Drilling Co., Wichita, has a rig working for Republic Natural Gas Co. at an outpost location west of the Fort Zarah pool, Barton County, Kansas. The operation is 1 Gunn, SE SW NE 25-19-13.

Loffland Brothers Co., Tulsa, is moving a rig to a wildcat location 4½ miles west of Cheneyville, Rapides Parish, Louisiana, where it will drill a Wilcox test for Warren Oil Corp. Location is for 1 Veal, in 33-1n-1e.

Service Drilling Co., Tulsa, is drilling for The Texas Co. at 1 Haxby, a Dakota exploratory test in the North Lodgepole area, Cheyenne County, Nebraska. Location is in the NE SE NW 15-15n-47w.

Puckett Drilling Co., Tulsa, is moving a rig to a location on the south side of East Watchorn pool in northwestern Pawnee County, Oklahoma, where it will drill a projected 4,300-ft. test for Arthur B. Ramsey at 1 Laird, NW SE NE 2-22n-3e. The rig has just completed the rotary hole of a well drilled for the same operator at the north end of the South Ceres pool in Noble County.

Summit Drilling Corp., Tulsa, is starting a Wilcox exploratory test for Oil & Gas Royalty Corp. in the area 13 miles northeast of Norman, Cleveland County, Oklahoma. The test is at 1 Go-Do-Pea-Se, in the C NW NE 17-9n-1e. Objective is expected around 6,300 ft.

Arrow Drilling Co., Tulsa, has the contract for a wildcat test which a group of companies, including Sun Oil Co., Royalite Oil Co., Albercan Oil Corp. and Act Oils, Ltd., is starting in the Sibbald area, southeastern Alberta Province, Canada. Location is for 1 Superba in LSD 4, 3-27-3w4.

Olds Oil Corp., Casper, Wyo., is the contractor on a wildcat test which Baxter Drilling Co. is starting in the East Sidney area, Cheyenne County, western Nebraska. Location is in SW NW NE 35-14n-49w.

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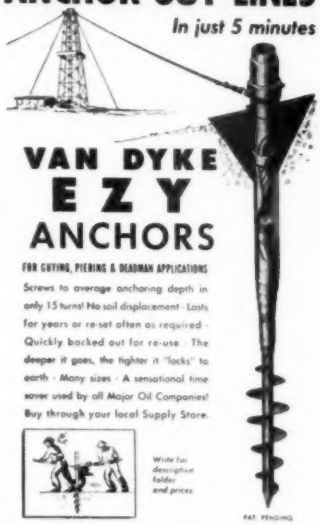

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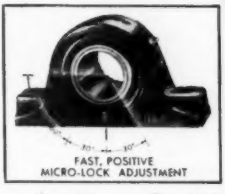

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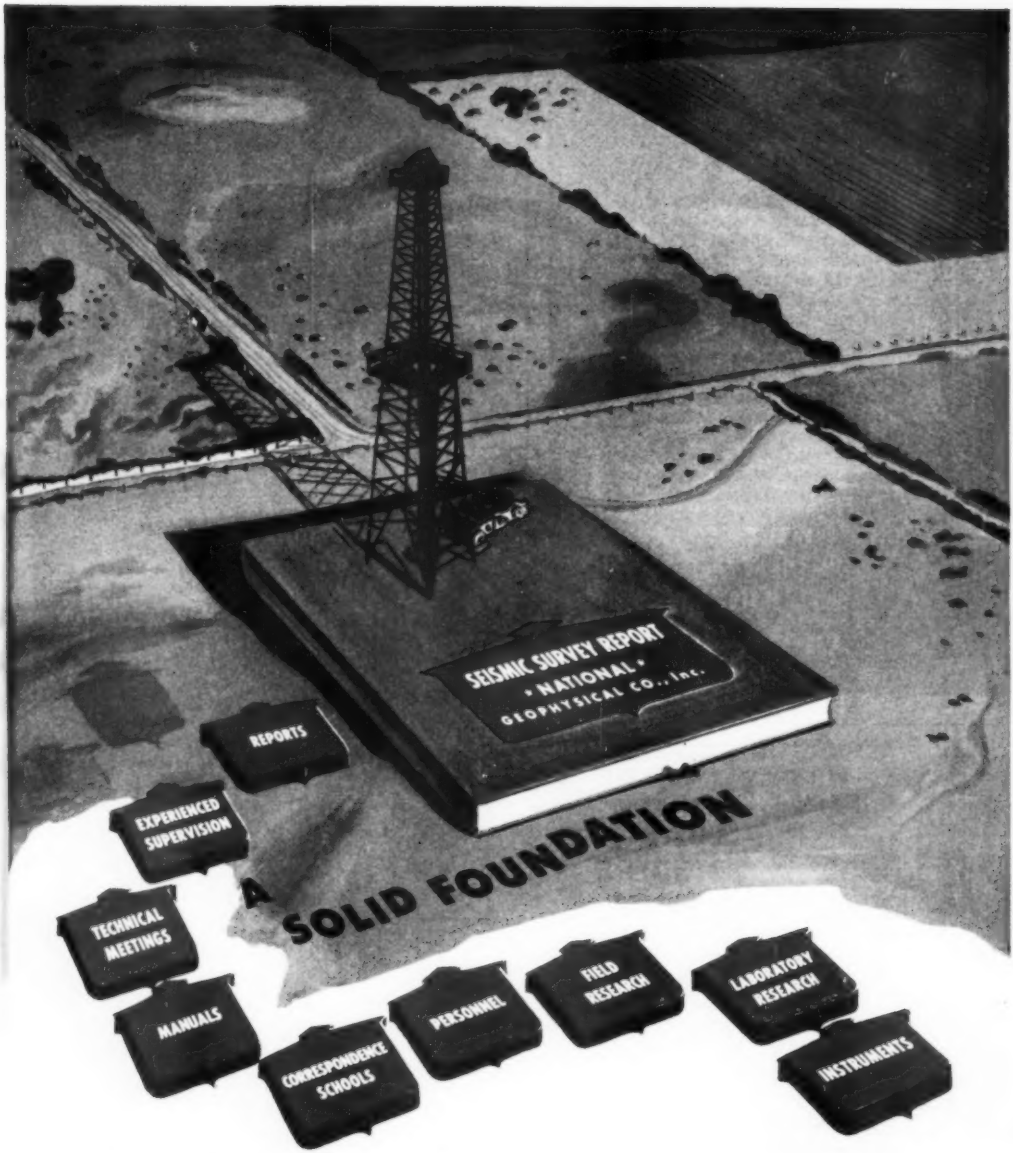

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Uinta Basin's Activity Climbs

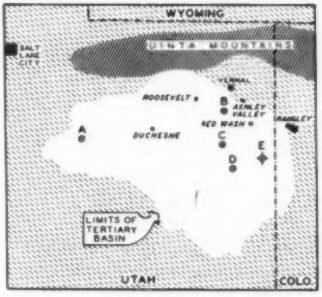
UTAH'S Uinta basin is rapidly gaining general recognition as harboring one of the outstanding undeveloped oil reserves in this country.

Those companies that stuck to their unpopular ideas through the early discouraging tests of the Tertiary-Green River formation, and now have interests in the unitized blocks on which the discovery wells were drilled, are getting sizable development programs under way. Once-skeptical companies have been sold on Uinta's potentialities and are now buying in and establishing units of their own with high hopes of ending up with a substantial share of the millions of barrels of oil that this basin is expected to yield.

Within the Tertiary Uinta basin there are now three fields: Roosevelt (1949), which proved that oil in commercial quantities can be found without drilling to the deep pre-Tertiary rocks; Red Wash (early 1951); and Duchesne (middle 1951). During 1950 the California Co. got a teaser at Gusher, 7 miles southeast of Roosevelt, but a confirmation test was completed dry so that this near-discovery is now considered to have lost the significance that it originally had.

Roosevelt and Red Wash are producing from the Green River formation. Duchesne produces from the deeper Tertiary-Wasatch. However, all three fields are actually producing from the transitional zone between the Wasatch and Green River. In Roosevelt and Duchesne this transitional zone is a highly fractured lake deposit of calcareous shale which responds to acidization. At Red Wash production is from several sands within this transitional zone.

Prior to the discovery of Roosevelt it was argued by some that the Tertiary in the Uinta basin would never produce oil because it is all of continental origin and that the spectacular surface occurrences of hydrocarbons were derived from dead oil deposited at the same time as the sediments themselves. The past 2 years have proven this argument invalid and emphasized that the line between a continental lacustrian deposit and a marine or brackish water deposit is but an academic question that has little bearing on the accumulation of oil.



The list of major companies demonstrating active interest in the Uinta basin is becoming impressive. Carter Oil Co. is in an enviable position. Being the sole aggressor during most of the pre-Roosevelt field days and still continuing an aggressive search for more fields, Carter has well earned the favorable position it occupies. Stanolind Oil & Gas Co. is in with Carter at Roosevelt field where a nine-well development program is well under way. Continental Oil Co. is in with Carter at Duchesne the most recent discovery where a second well has indicated the possibility of production of oil at only 3,000 ft. against 7,600 ft. in the initial well. Carter is drilling three wildcats in the Uinta basin, one at A, one at D (see map), and one a few miles to the east of Roosevelt field.

The California Co. has a 16-well development program planned at its Red Wash field with the ninth location recently announced. Phillips Petroleum Co. has a well drilling at Roosevelt and Gulf Oil Co. has staked a location in this field. At E Continental has completed the first of a series of tests planned to evaluate a sizable block. Stanolind and Mid-Continent Petroleum Corp. are drilling a wildcat at B and Sun Oil has one digging at C.

Turning the Uinta basin into an important oil-producing province is not going to be all roses. Tests are expensive. Suggested answers to the questions about how to handle the high-pour-point crude and where to send it once substantial production has been developed have yet to be sifted. Current indications are, however, that the rewards merit the expense and that the right answers will be selected in time to prevent any slowing of Uinta's increasing activity. —*Philip C. Ingalls.*

HIGHLIGHTS OF WEEK'S DEVELOPMENTS

WEST TEXAS.—Sinclair 3-C June Tippett, Midland County, had further pay without water in drill-stem testing to 13,093 ft.; pipe was on bottom at 13,133 ft. and ready for completion attempt. Signs of Spraberry Times: The past week's completions gave Pembrook area three major extensions, and Sohio spotted locations for 20 new wells, all Pembrook outposts.

EAST TEXAS.—A major Pennsylvanian well was ready for completion, south of Ellenburger and Simpson producers in Sandusky field of Grayson County. Mid-Continent Petroleum Corp. 1 Martin gaged 300 bbl. of 30°-gravity oil in 24 hours through ¼-in. choke, from pay at 6,912-7,001 ft. Previous Pennsylvanian pay, on the north side of the field, has been small.

ROCKY MOUNTAIN AREA.—E. Julian Davis (Davon Oil Co.), and C. D. Edmonson and Kansas-Nebraska Gas Co. apparently have each found new gas discoveries in the Nebraska portion of the Denver-Julesburg basin. Wildcat drilling in this area is continuing at a rapid rate, with exploratory drilling extending beyond previous producing limits of the basin.

CANADA.—Shell Oil Co. Dahinda 1, LSD 6, 2-9-23w2, medium oil strike in southern Saskatchewan, made 25 bbl. of 20°-gravity oil in the Mississippian dolomite. This discovery marks the first production in this province's limits of the Williston basin.

North Central Texas

Montague County Discovery Potentials 177 Bbl. Per Day

WICHITA FALLS.—Montague County had a new discovery just north of the town of Montague, and a well drilled dry last year was seeping oil.

The new producer is George S. Engle 1 Fenoglio, J. Brumley Survey, about 1½ miles north of the town site. Hole was drilled to 6,415 ft. then completed through perforations between 5,966-81 ft. Completion potential was 59 bbl. of 40°-gravity oil in 8 hours.

Two miles north of Belcherville, National Associated Petroleum Co. 1 Lowery was dry last year at 6,100 ft. According to reports, the well had oil seepage recently and when reentered produced 35 bbl. of 26°-gravity oil. Operators set casing at 900 ft. and continued bailing, making oil and some fresh water.

Southeast of Montague, Cities Service Oil Co. 1-D Zahn, in the Kennedy area, was dry at 6,440 ft. Oil and gas-cut mud was recovered on drill-stem test from 6,420 ft.

Gulf Oil Corp. 45 Nichols, Block 37, AT-NCL Survey, 6½ miles southeast of Holliday, opened Ellenburger production in north-central Archer County. The well kicked off and flowed 112 bbl. of load-oil plus 110 bbl. of new oil in 8 hours. The flow was through 24/64-in. choke from open hole between 5,350-5,414 ft., plugged-back total depth. A drill-stem test of the same interval had produced 1,040 ft. of oil plus some salt water in 6 hours. Nearest Ellenburger production is 8 miles northwest in the Browning field.

In Nolan County, Seaboard Oil Co. 1 Billie Hanks, northeast of Blackwell, was drilling below 5,170 ft. following a test from 4,752-77 ft. which yielded sulfur water. The well had found no further shows below the section at 4,584-4,609 ft.

Northeast of Maryneal, C. L. Norsworthy, Jr. 2-A Brooks was drilling shale and sand at 6,036 ft. No shows had been reported.

Skelly Oil Co. 2 Adrian southeast of Sweetwater recovered salt water on a 3-hour test at 3,362-72 ft. and was drilling below 5,180 ft.

NORTH CENTRAL TEXAS (DISTRICTS 9 AND 7-B) SUCCESSFUL WILDCATS

Clay County: Stephens Petroleum Co. 1 Vinson, T&NO Sur., 5 mi. E Henrietta, TD 6,260 ft., Simpson 6,208 ft., perf. 6,208-29 ft., IP: flowed 221.7 bbl. 46°-gravity oil a day, ¼-in. choke, TP 400 psi., GOR 650 cu. ft.

Eastland County: Big Six Oil Co. 1 B. W. Martin, 80-4-H&TC, 1 mi. NE Cisco, TD 4,043 ft., elev. 1,622 ft., perf. 3,452-64 ft., IP: pumped 10 bbl. 40°-gravity oil.

Foard County: British American Oil Co. 1 W. B. Johnson, 32-A-T&NO, 20 mi. NW Crowell, TD 7,672 ft., elev. 1,582 ft., Caddo 6,162 ft., perf. 6,170-80 ft. IP: flowed 171 bbl. 42°-gravity oil a day, 18/64-in. choke, TP 100 psi., GOR 830 cu. ft.

Throckmorton County: Warren Oil Corp. 1 G. Williams, A-1,455, J. H. Williams Sur., TD 4,378 ft., elev. 1,427 ft., dual completion, Caddo perf. 3,565-80 ft. IP: flow 310 bbl. 40°-gravity oil, 18/64-in. choke, TP 160 psi., GOR 161 cu. ft. Mississippian pay 4,367-78 ft. IP: flowed 734 bbl. 42°-gravity oil a day, 20/64-in. choke, CP 340 psi., GOR 386 cu. ft.

NORTH CENTRAL TEXAS (DISTRICTS 9 AND 7-B) WILDCAT FAILURES

Archer County: An-Son Petroleum Corp. 2 J. R. Parkey, SPRR Sur., A-423, dry, TD 1,500 ft.

G. W. Cooper 1 Williams, J. Hand Sur., A-182, dry, TD 4,466 ft.

Larson & Thomas 1 Turbeville, Sec. 157, R. Carson Sur., dry, TD 1,567 ft.

J. J. Lynn 1 E. A. Maag, 22-A1,279-H&TC, dry, TD 5,207 ft. in Caddo lime.

Perkins Brothers 2 Olin Calvin, R. Grooms Sur., A-155, dry, TD 989 ft.

T. M. Weatherford 1 R. A. Crowell, E. G. Knight Sur., A-900, dry, TD 701 ft.

Brown County: G. F. Mulkey 1 D. N. Markham, Blk. 3, Henry Brewster Sur. 790, dry, TD 1,200 ft.

Coleman County: C. O. Davis 1 Alfred Herring, Sec. 757, D. McLean Sur., dry, TD 3,650 ft., elev. 1,979 ft., Fry 3,379 ft., Jennings 3,480 ft.

C. U. Norton 1 C. H. Wilder, D. A. Murdock Sur. 738, dry, TD 2,334 ft.

H. E. White 2 R. W. Hosch, Sec. 25, H. Crocheron Sur. 656, dry, TD 2,518 ft.

Cooke County: Acme Equipment, Inc. 1 W. F. Solomon West Ranch, 7-A976-SPRR, dry, TD 2,846 ft.

Eastland County: Fred Birdsong 1 W. T. Duncan, H. Kendrick Sur., dry, TD 1,600 ft.

Hickok & Reynolds, Inc. 1 L. E. Harrell, 15-2-BBB&C, dry, TD 4,155 ft., elev. 1,620 ft., Ranger 3,772 ft., Ellenburger 4,030 ft.

Ben J. Weinberg 1 L. A. Ramsower, 38-4-H&TC, dry, TD 2,000 ft.

Jones County: Jones & Stasney 1 Mrs. Eula Phillips, B-334-Harrison CSL, dry, TD 3,200 ft., elev. 1,728 ft., Flippen 2,538 ft.

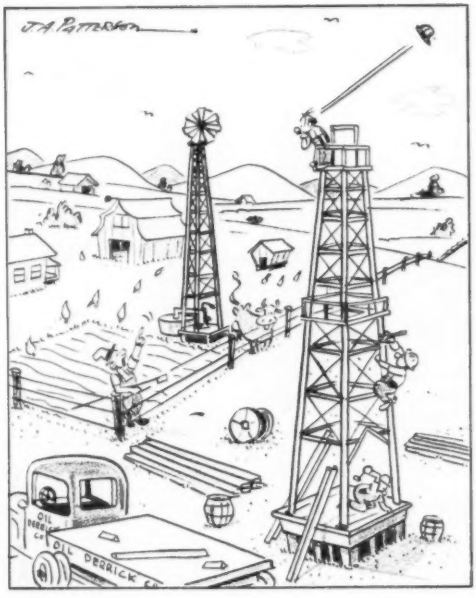
Jones & Stasney 1 D. E. Prewit, Sec. 22, D&DAL, dry, TD 3,550 ft.

G. B. & J. H. Rice 1 Fred Bueger, Sec. 41, D&DAL, dry, TD 3,105 ft., elev. 1,700 ft., Flippen 1,960 ft., reef 2,970 ft.

Roark-Hooker-Hill & Duncan 1 A. A. Propst, 8-208-M. Fragosa Sur., dry, TD 4,807 ft., elev. 1,768 ft., Palo Pinto 4,450 ft.

C. B. Schwartz 2 M. J. Merchant, Blk. 263, H. Virm Sur., dry, TD 4,900 ft., elev. 1,710 ft., Flippen 2,485 ft., Palo Pinto 4,135 ft.

Trinity Production Co. 1 W. U. Shannon,



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Shackelford County: Big West Drilling Co. 2-1 T. G. Hendrick, Sec. 159, ETRR Sur., dry, TD 1,518 ft.

Big West 1 J. H. Nail 22, Sec. 125, ETRR, dry, TD 1,473 ft.

Big West 2 Nail, Sec. 19, ETRR, dry, TD 1,010 ft.

Big West 2-9 Nail, Sec. 46, ETRR, dry, TD 1,253 ft.

Big West 2-22 Nail, Sec. 152, ETRR, dry, TD 1,541 ft.

Big West 3-9 Nail, Sec. 70, ETRR, dry, TD 1,260 ft.

Woodson Oil Co. 2-C Paul Pitzer, Sec. 509, TE&L Sur., dry, TD 860 ft.

Stephens County: Marshall Pipe & Supply Co. 1 D. C. Pratt, 48-6-T&P, dry, TD 2,002 ft.

Stonewall County: Oxford Drilling Co. 1-A Lewis, 159-1-BBB&C, dry, TD 3,503 ft., elev. 1,723 ft., Swastika 3,444 ft.

Seaboard Oil Co. 1 A. P. Kennedy, 297-2-H&TC, dry, TD 6,496 ft., elev. 1,778 ft., Caddo 6,041 ft., Ellenburger 6,430 ft.

Taylor County: Sid Katz & Venable 1 John Stockton, 53-1-SPRR, dry, TD 5,000 ft., elev. 2,028 ft., Caddo 4,660 ft., Ellenburger 4,942 ft.

Wichita County: Fortex Oil Corp. 1 E. M. Horton, BBB&C Sur., A-28, dry, TD 1,500 ft.

Chas. E. Pfeifer 1 Pfeifer, Blk. 37, Denton CSL, dry, TD 1,900 ft.

Young County: James Blair Baker 1 M. K. Graham, Sec. 3,410, TE&L, dry, TD 2,662 ft.

C. H. Peterson 1 E. R. Prideaux, S. Tynes Sur., dry, TD 510 ft

South Louisiana

Texaco Set to Test Deep Jefferson Parish Wildcat

NEW ORLEANS.—Casing has been set in The Texas Co. 1 Bradish-Johnson, Jefferson Parish wildcat, and operator is preparing to test the deep venture. Hole is bottomed at 14,005 ft. and operator set 5-in. liner to total depth. It is reported that initial tests will be made through perforations at 13,816-26 ft. Success would mean the first new strike in Jefferson Parish since the discovery of 2-year-old Avondale field approximately 10 miles from here.

Hunt Oil Co. and associates have staked location for a new 8,000-ft. wildcat south of production in South Larto Lake field, Avoyelles Parish. Venture is 3 George G. Snowden, Jr., et al, 1-3n-5e. The same operators have drilled 2 dry holes in the immediate vicinity of the new test.

Meanwhile, also in Avoyelles Parish, Sinclair Oil & Gas Co. 1 Turner Lumber Co., 29-2s-6e, recovered fish and is now coring at 12,062 ft. The wildcat has a projected depth of 13,000 ft.

Humble Oil & Refining Co. is preparing to drill ahead below 9,264 ft. at 1 State Lease 1868, wildcat in Four League Bay, Terrebonne Parish. Protective string of 9⅝-in. casing was cemented at 9,264 ft., and operators are drilling toward contract depth of 14,000 ft.

Tools are below contract depth of 14,000 ft. at Union Producing Co. and Texas Gulf Production Co. C-1 La Terre Co., Inc., wildcat in the Dulac area of Terrebonne Parish. Operators were reported drilling at 14,530 ft. with no shows indicated.

The Texas Co. 2 Bernstein Bros., wildcat east of Bay Brussee, Jefferson Parish, was dry at total depth of 10,537 ft. No shows were encounterd.

SOUTH LOUISIANA SUCCESSFUL WILDCATS

Terrebone Parish: Gas-distillate discovery—(offshore)—Magnolia Petroleum Co. A-1 State Lease 794, South Pelto Block 20, TD 9,228 ft., Miocene 8,192-92 ft., IP: 42 bbl. condensate, 50.6° gravity.

Gas discovery—(offshore)—Shell Oil Co. 1

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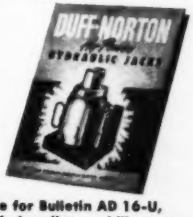

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State Lease 1799, Ship Shoal Block 23, TD 14,000 ft., Miocene 2,657-62 ft., IP: 1,432,000 cu. ft. of gas daily, 16/64-in. choke, TP 1,000 psi.

West Baton Rouge Parish: New pay at Grosse Tete—Sohio Petroleum Co. 2 A. Wilbert & Sons "B," 31-7s-11e, TD 9,942 ft., perf. 9,696-9,705 ft., IP: 1,980,000 cu. ft. of gas daily plus 56 bbl. condensate, 16/64-in. choke, TP 1,350 psi.

SOUTH LOUISIANA WILDCAT FAILURES

Lafourche Parish: Richardson & Bass 1-E Allen Land Co., Inc., 17-20s-23e, dry, TD 13,530 ft.

Terrebonne Parish: The Texas Co. 1 Southdown Sugars, Inc., 69-17s-16e, dry, TD 11,495 ft.

Kansas

Decatur County Added To Kansas Production

DECATUR County is being added to the producing counties of the state with the completion by The Texas Co. of its 1 Keenan, NW NW SE 24-5-27. Producing from the upper of two Lansing lime zones previously tested, the well pumped 185 bbl. of oil with 77 bbl. of water in 24 hours. Located in the eastern part of the county, the well, the first in the county, is 8 miles from nearest other production, the small Adell pool in northeastern Sheridan County to the south.

In initial swabbing tests, made with casing perforated at 3,478-82 ft. and 3,484-88 ft., well produced 70 bbl. of oil and 125 bbl. of water in 14 hours. Since then the perforations have been cemented and casing reperforated only in the upper interval at 3,478-82 ft. Top of the pay is 3,407 ft. (—906 ft.). Hole is plugged back to 3,503 ft. from its orginal total depth of 3,925 ft. in granite, topped at 3,894 ft. The well also had showings in the Topeka, topped at 3,220 ft. (—721 ft.), and the Marmaton at 3,591-3,605 ft. These zones have not been tested, although drill-stem tests were made, getting oil-cut mud.

Alpine Oil & Royalty Co. has established a flow potential of 346 bbl. per day at its 1 McIlracht, NE NE NW 19-19-12, which opens a new producing area 1½ miles north of the Fort Zarah pool, 4 miles east of Great Bend, Barton County. Pay zone is in the Lansing-Kansas City section, in which casing is perforated at 3,208-14 ft.

At the north end of the Fort Zarah pool, M-M-R Oil Co. 3 Stark, NW NW NW 32-19-12, has been given a flow potential rating of 728 bbl. to prove another good producer for the area, one of the most active in the state. Production is from casing perforations in Lansing-Kansas City lime at 3,264-74 ft., 3,285-90 ft., and 3,304-10 ft. Hole is plugged back grom the Arbuckle lime, logged at 3,384-98 ft.

C-G Drilling Co. 1 Olson, SE SE SW 15-12-22, 2 miles northwest of the Ogallah pool, Trego County, recovered 75 ft. of oilcut mud in a 60-minute drill-stem test in the top of the Arbuckle at 4,093-4,103 ft. and has run casing for completion. Surface elevation is 2,380 ft.

Missouri.—A Carroll County wildcat, Gilcrist 1 O'Roark, encountered a small show of oil in the St. Peter formation. Located in C SW SE 22-55n-24w, on an elevation of 974 ft., the well topped the Mississippi lime at 680 ft. and the St. Peter at 1,100 ft., It is planned to drill ahead below the current depth of 1,300 ft.

KANSAS SUCCESSFUL WILDCATS

Butler County: Eckland Drilling 1 Neiman, SW NW SE 9-25s-3e, pumped 25 bbl. oil from Mississippian at 2,759-60 ft., TD.

Stafford County: Todd Drilling 1 Wendelburg, SE SW NE 29-23-11w, pumped 371 bbl. oil from Arbuckle at 3,720-32 ft., TD.

KANSAS WILDCAT FAILURES

Cowley County: Carter 1 Warren, SW NW NE 4-35s-5e, dry, TD 3,181 ft.

Decatur County: Gore 1 Johnson, NW NW SW 9-3s-27w, dry, TD 4,250 ft.

Ellis County: Brooks Pierce 1 Meringer, NE NE SE 26-13s-18w, dry, TD 3,724 ft.

Graham County: Gore 1 Bell, SW SW NW 14-6s-24w, dry, TD 4,221 ft.

Deep Rock 1 Smika, NW NW NE 8-7s-22w, dry, TD 3,990 ft.

Lario 1 Gustafson, NW NW NE 25-9s-22w, dry, TD 3,967 ft.

Gore 1 Justus, NW NW NW 33-9s-23w, dry, TD 4,502 ft.

Gove County: Nye 1 Lundgren, NW NW NW 29-14s-29w, dry, TD 4,288 ft.

Hodgeman County: B & R 1 Sinclair, SW SW SW 23-21s-26w, dry, TD 5,040 ft.

Meade County: Columbian Fuel 1 Adams "E," NW NW NW 15-34s-30w, dry, TD 6,270 ft.

Pawnee County: Derby 1 Thomas, NE NE SE 19-23s-16w, dry, TD 4,343 ft.

Phillips County: LeBlanc et al 1 Bayerlein, NW SE SE 1-3s-19w, dry, TD 3,610 ft.

Rice County: Allan et al 1 Evans, SEL NE SE 33-20s-8w, dry, TD 3,361 ft.

Rooks County: Deep Rock 1 Grievel, NW SE SE 16-7s-19w, dry, TD 3,453 ft.

Brooks Hall et al 1 Casey, SW NE SW 20-9s-19w, dry, TD 3,633 ft.

Stafford County: Koplin 1 Thurow, NE NE SW 36-24s-15w, dry, TD 4,470 ft.

Wabaunsee County: Woods 1 Crosby, SE NW SE 7-12s-10e, dry, TD 3,551 ft.

California

Los Angeles County Test Opens New Mohnian Field

LOS ANGELES.—After several weeks of unsuccessful wildcatting, California was given a new oil-field discovery, and three additional field or pool openers seemed assured. In addition, a recent gas discovery was given a ½-mile extension.

The new field discovery was in the expanding Castaic Junction area of Los Angeles County. The successful wildcat was Ted Sterling 1 Rynne-Fisher, NE NE Section 35-5n-17w, in which Continental Oil Co. has a half interest. Located about 1¾ miles northeast of the Honor Rancho field, the discovery was completed in a Mohnian sand at 4,632-96 ft., flowing 33°-gravity crude at the rate of about 600 bbl. daily. On a later test it flowed at an hourly rate of 35 bbl. with 300 psi. casing pressure.

In the Basin area of Los Angeles County, the deep test being drilled by Continental Oil Co. in the Seal Beach field again attracted attention. The well, 62 Bixby in Section 2-5s-12w., on a test at 7,995-9,943 ft., swabbed and flowed 110 bbl. of oil in 8½ hours. This would be a new deeper pay for the field.

In July the interval 7,723-7,894 ft. was tested in 62 Bixby. Based on a 2-hour test the well indicated a 500-bbl. producer at that depth, a new-zone discovery for the field. Following last week's test, when hole was bottomed at 9,943 ft., Continental planned to resume coring.

At Sunset Beach in Orange County, Algonquin Oil Co. set 7-in. casing at 4,448 ft. in its 1 Well in Section 29-5s-11w. Drilled to 4,639 ft. and plugged back to 4,500 ft., casing was run in the well after testing the interval 4,450-4,500 ft., the results of which were reported to be inconclusive.

In the San Joaquin Valley region, interest was attracted by showings of wildcats being drilled by Superior Oil Co. and Humble Oil & Refining So. Superior's 54-29 Theta, ½-mile west of production in Bacon Hills field, was being rated as a new-zone discovery in the upper Middle Miocene. Drilled to 4,563 ft. and then redrilled to 2,210 ft., where 5-in. casing was landed, the wildcat was in the process of completion at last reports.

In the Rosedale area about 2 miles east

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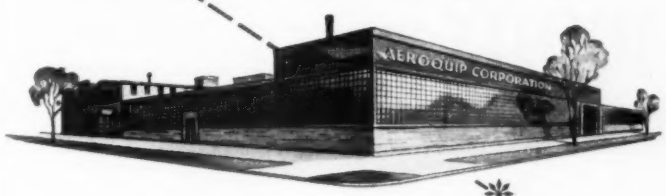

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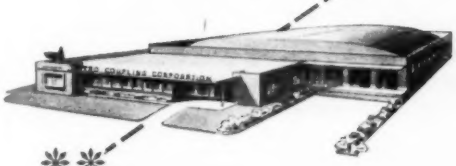

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*** *Metalco, Inc., a new Aeroquip subsidiary, operates this plant in Cheboygan, Michigan.*

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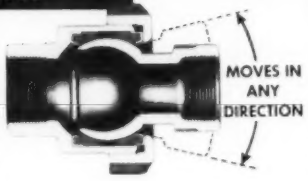

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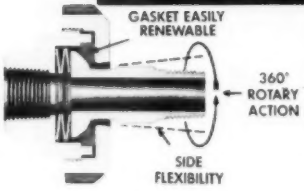

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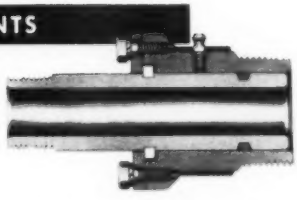

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of the Greeley field, Humble 1 Rosedale-Stevens Community showed for a new field opener on a drill-stem test at 5,921-45 ft. After the tool had been open for 1 hour, about 1,800 ft. of 30°-gravity crude was recovered. Following the test Humble resumed coring and at the week end had reached 6,258 ft., where drilling was haulted to make an electrical survey.

About 1½ miles northwest of Fresno County's recent Camden discovery, Santa Fe Drilling Co. completed its 1 Dyson for a field opener. The wildcat flowed about 140 bbl. of 33.8°-gravity crude daily from 10 ft. of oil sand between 6,093-6,105 ft. Its location is in SW NE Section 6-17s-20e.

In northern California, Honolulu Oil Corp. gave new Princeton gas field in Butte County a ½-mile west extension, the well being completed for 4,800 M.c.f. daily at 3,259-3,314 ft.

In Yolo County ¾ mile south of the Pleasant Creek gas field, Mohawk Petroleum Corp. set casing at 3,000 ft. in its 1 Pleasant Creek Unit-5. Located in Section 17-8n-1w, the potential extensioner had been plugged back from 3,523 ft.

CALIFORNIA SUCCESSFUL WILDCATS

Butte County, ½-mile west extensioner to Princeton field: Honolulu Oil Corp. 2 Honolulu-Humble-Wild Goose, SE 18-17n-1e, flowed 4,800 M.c.f. per day, perf. 3,259-72 ft., 3,302-14 ft., TD 3,435 ft., plugged back to 3,340 ftl, elev. 66 ft.

Fresno County, new oil field in Camden area: Santa Fe Drilling Co. 1 Dyson, SW NE 6-17s-20e, flowed 48 bbl. of 33.8°-gravity crude in 14 hours from 35 ft. of perforations above 6,105 ft., top oil sand 6,093 ft., TD 6,576 ft., plugged back to 6,110 ft., elev. 260 ft.

CALIFORNIA WILDCAT FAILURES

Fresno County, Raisin City area: Seaboard Oil Co. 74-34 Seaboard-S. A. & F. L., 34-15s-18e, dry, TD 7,468 ft., elev. 223 ft.

Kern County, Tejon Hills area: Leroy C. Gould 18-1 Tejon, 18-11n-17w, dry, TD 848 ft., elev. 1,275 ft.

Devils Den area: B. C. Mackey 1 Indep.-Dagany Gap, 3-25s-18e, dry, TD 2,089 ft., elev. 604 ft.

Rack Track Hill area: Kern Oil Co., Ltd., 82 Portals, 33-29s-29e, dry, TD 4,968 ft., elev. 702 ft.

Tejon Hills area: Nels A. Madsen 1 Louise, 11-11n-18w, bottomed in basement, dry, TD 1,451 ft., elev. unreported.

Orange County, Corona del Mar area: Shell Oil Co. 51-130 Irvine Four, 5-7s-9w, dry, TD 9,043 ft., elev. 380 ft.

Anaheim area: Continental Oil Co. 4-1 Anaheim Comm., 5-4s-10w, dry, TD 10,679 ft., elev. 143 ft.

San Luis Obispo County, Elkhorn Plains area: Colquitt Drilling Co. 1 Colquitt, 7-32s-22e, dry, TD 921 ft., elev. 2,486 ft.

San Mateo County, San Gregorio Creek area: Bell & Burden, Inc., 1 Riskin, 13-7s-5w, dry, TD 4,500 ft., elev. 112 ft.

Stanislaus County, Waterford area: Paul L. Cooper et al 1 Metzger, 23-3s-11e, dry, TD 3,301 ft., elev. 165 ft.

Eastern Texas

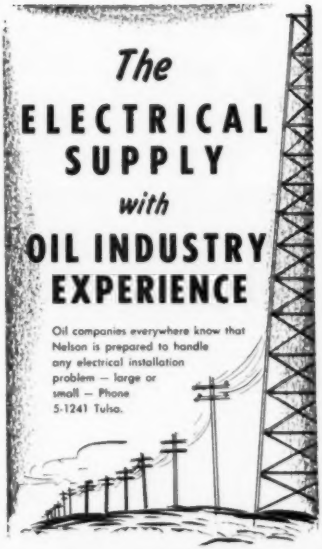
Grayson County Wildcat Activity Continues High

DALLAS.—Grayson County activity continues high with a number of wildcats and extension attempts drilling.

The Texas Co. 1 Charles A. Neal, Stickney Survey, was in shale and sand at 6,162 ft. The same company's 2 Marshall, E. Hartzog Survey, was drilling at 6,391 ft.

Mid-Continent Petroleum Co. 1 Martin, Walker Survey, and 1½ miles south of nearest Ellenburger production in the Sandusky area, prepared to complete from open hole in the Pennsylvanian at 6,912-7,001 ft. Last reported test, from 6,898-6,993 ft. developed 6,850 ft. of oil in 1½ hours.

Humble Oil & Refining Co. 1 Lester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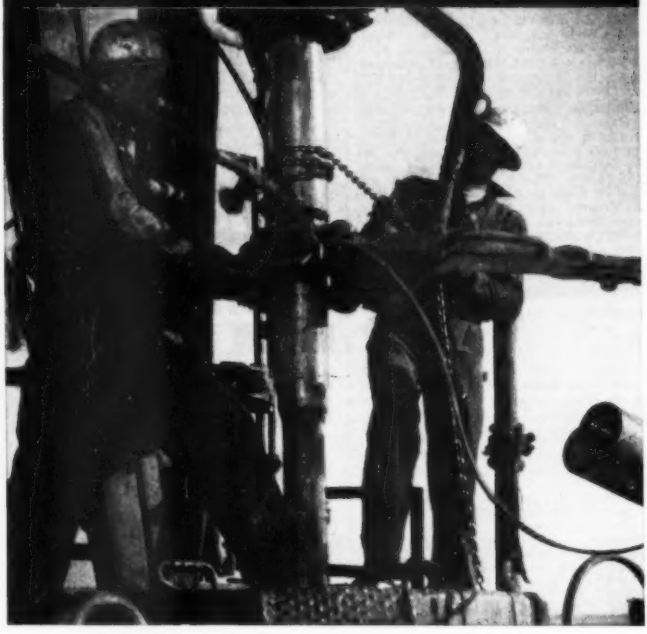

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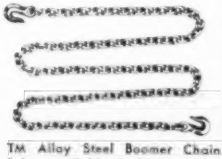

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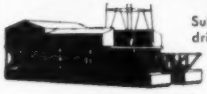

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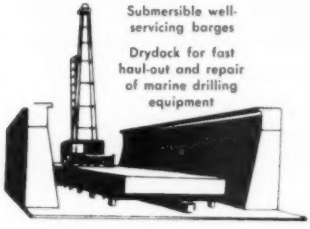

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Foran, Leon County wildcat, was to back up the hole for tests, according to field sources, after drilling to 10,610 ft. The well had good shows of production while drilling in the Woodbine around 5,700 ft. and some gas shows in the Rodessa around 9,100 ft.

In Wood County, F. R. Jackson 1 E. A. Byers north of the sub-Clarksville discovery of the Deupree field apparently missed that pay in drilling to 6,483 ft., and operators were taking side-wall cores in the Woodbine. Following the cores, casing was set at 5,803 ft. for perforating and testing. Core data had not been released.

In Harrison County, Zephyr Oil Co. 1 E. S. Bogue, wildcat 7 miles west of Waskom, had total depth at 6,580 ft. in the Travis Peak and was running casing to bottom. Several sections had shows while drilling, including a gas-distillate section in the Pettit from 6,140-65 ft.

EAST TEXAS (DISTRICTS 5 AND 6) WILDCAT FAILURE

Franklin County: Atlantic Refining Co. 1 Glenn Freeman, J. P. Riddle Sur., 3 mi. SE Mt. Vernon, dry, TD 7,293 ft., elev. 474 ft., Paluxy 5,225 ft.

Texas Gulf Coast

Montgomery County's New Oil Discovery Potentials 96 Bbl.

HOUSTON.—Potential test has been run at a new oil discovery in the Willis area of Montgomery County. The strike is PLD Well Service Co. 3 Tony R. Snow, William Weir Survey, Abstract 42. On initial test the well flowed 96 bbl. of 28°-gravity oil daily through 10/64-in. choke under tubing pressure of 20 psi. Production is through perforations at 3,732-34 ft. Hole is bottomed at 3,746 ft. with 5½-in. casing cemented on bottom. This well is flanked on the northeast and south by the same firm's 1 and 2 Snow, both gas producers.

Liberty Townsit received a new pay opener at Floyd L. Karsten 1 Geraldine Humphries. This well is located on the north flank of South Liberty field, Liberty County. The well flowed 94 bbl. of 42.3°-gravity oil daily through perforations at 9,085-150 ft. Flowing pressure on the tubing was 4,350 psi. Hole is bottomed at 9,500 ft.

Another new Liberty County pool has been opened at Sohio Petroleum Co. 1 B. E. Quinn, Humphries Survey, Abstract 212. The well is reported to have flowed an estimated 2,000,000 cu. ft. of gas daily plus 37 bbl. of 52.4°-gravity distillate per million cubic feet of gas. Production is from 7,170-75 ft. This wildcat is 4 miles south of Cleveland field.

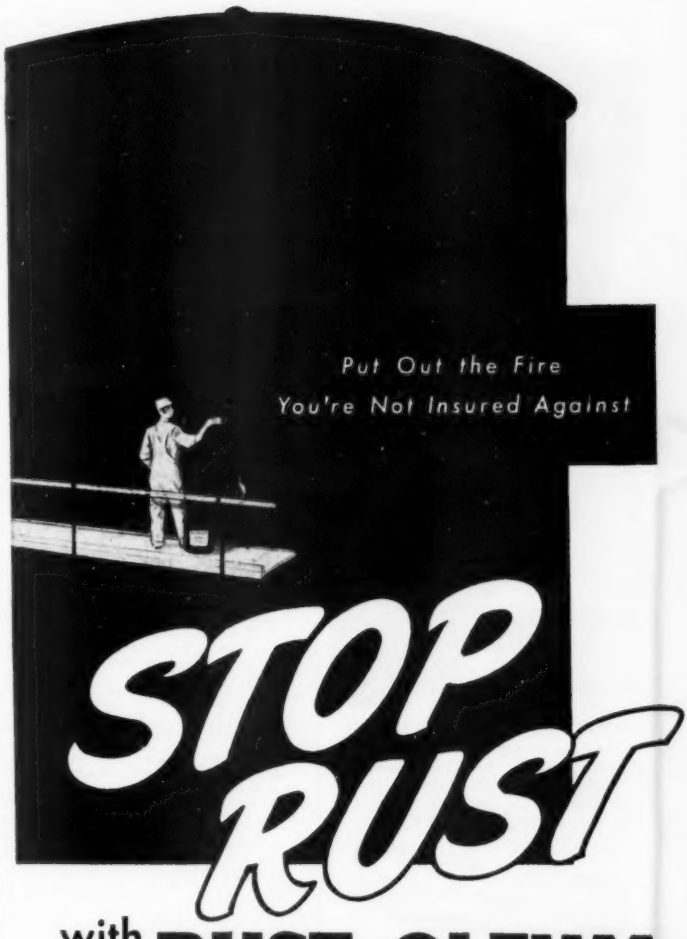
A gas discovery is being completed 1 mile northwest of Coletto Creek field in Victoria County. G. W. McCarter 1 Alex Angerstein, wildcat, will probably be completed from two gas zones, the 2,200 ft. and 3,200 ft. sections.

Potential gage has been run on the biggest producer in Nelson field, Hardin County, which also shows indications of opening a new pay sand for the area. American Republics Corp. and Houston Oil Co. of Texas 1 Mary J. Cunningham, et al, flowed 122 bbl. of 40.9°-gravity oil daily through 7/64-in. choke. Production is through perforations at 7,078-82 ft. Tubing pressure was 1,077 psi. Nelson field was opened last year by the same operators' 1 Nelson, which was completed as a gasser. The 2 Nelson, 700 ft. west of the new well, was finaled as an oil-sand discovery from perforations at 6,974-76 ft.

TEXAS GULF COAST (DISTRICTS 2 AND 3) SUCCESSFUL WILDCATS

Bee County: Gas-condensate discovery—Newman Bros., Alaska Steamship Co., et al, 2 Chas. Mengers, G. Garcia Sur., A-167, TD 4,930 ft., perf. 4,800-20 ft., IP: shut in, no gage, SIP 2,202 psi.

Jefferson County: New pay at Big Hill—



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McCarthy Oil & Gas Corp. 1-B Mrs. Dora Gill, et al, "B," T&NO RR Sur., A-375, TD 9,714 ft., perf. 8,445-52 ft., IP: 144 bbl. oil per day, 7/64-in. choke, 33.5° gravity.

Liberty County: New pay at South Liberty—Floyd L. Karsten 1 Geraldine Humphries, East League of Liberty Townsite, TD 9,500 ft., perf. 9,085-9-140 ft., IP: 94 bbl. oil per day, ⅛-in. choke, 42.3° gravity.

Gas-condensate discovery — Sohio Petroleum Co. 1 B. E. Quinn, James Humphreys Sur., A-212, TD 10,962 ft., Yegua 7,170-75 ft., IP: 74 bbl. condensate per day plus 2,000,000 cu. ft. of gas, 52.4° gravity.

Montgomery County: Oil discovery—PLD Well Service Co. 3 Tony R. Snow, et al, William Weir Sur., A-42, TD 3,746 ft., perf. 3,732-34 ft., IP: 96 bbl. oil per day, 10/64-in. choke, 28° gravity.

TEXAS GULF COAST (DISTRICTS 2 AND 3) WILDCAT FAILURES

Bee County: Bridwell Oil Co. 1 B. F. Hirsch, Geo. O'Docharty Sur., A-49, dry, TD 4,010 ft.

Calhoun County: Alcoa Mining Co. 1 C. M. Foester, et al, Narciso Cabazos Sur., 2 mi. W of Magnolia Beach, dry, TD 8,889 ft.

Salt Dome Production Co., et al, 1 State of Texas, Tract 144, in San Antonio Bay, dry, TD 6,380 ft.

DeWitt County: Columbia Drilling Co. 1 E. A. Gohlke, Stephen Best League, dry, TD 9,086 ft.

Fayette County: Thos. Jordan, Inc., et al, 2 W. A. Rosanky, Joseph McAllister League, dry, TD 4,506 ft.

Goliad County: Ryan, Hays & Burke 1 H. C. Nutt, et al, Sampson McTornal Sur., A-195, dry, TD 3,196 ft.

Harris County: L. D. Cain 1 Mary McBride, C. L. Hart Sur., A-1410, Sec. 8, dry, TD 8,000 ft.

Jackson County: Hankamer Investment Co. 1 Herman S. White Estate, Stephen F. Austin Sur., A-5, dry, TD 7,655 ft.

J. M. Huber Corp. 1 L. R. Hollingsworth, Eli Mercer Sur., D-54, dry, TD 4,210 ft.

Karnes County: The Chicago Corp. 1 Robert E. Goetz, Carlos Martinez Grant, A-6, dry, TD 3,500 ft.

Kirkwood & Co. and Weaver & Sharp, 1 W. Boyce, Vistoria Blanco Grant, dry, TD 7,653 ft.

Live Oak County: Delhi Oil Corp. 1 Maxine Means, C. F. Simmonds Subd., dry, TD 7,524 ft.

Refugio County: Superior Oil Co. 2 R. H. Welder, Juan Pobedano Sur., A-49, dry, TD 6,350 ft.

Mississippi

Humble Prepares to Test Pike County Rank Wildcat

JACKSON.—Humble Oil & Refining Co. has cemented production casing in 1 Bill Fortenberry, C NE SE 27-2n-9e, rank Pike County wildcat, and is preparing to begin testing. The well is bottomed at 12,000 ft., and operator set 7-in. production string at 11,297 ft. Drilled as a tight hole, no information has been released on the wildcat. It is reported, however, that Humble ran several drill-stem tests around the 11,000-ft. interval. If completed successfully, this well will establish the first production in Pike County.

Drilling operations are slated to get under way immediately at a new Adams County wildcat 3 miles east of Kingston field. Test is Paul Ratliff 1 Francis Geddes, 25-5n-1w, and has a projected depth of 7,600 ft. It is expected to test all sands of the Wilcox formation.

Another new Adams County wildcat is Humble Oil & Refining Co. 1 E. Virginia Benbrook, 67-7n-2w, approximately 1 mile northeast of LaGrange field. Projected depth of the venture is 6,500 ft.

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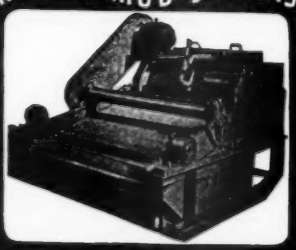

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Alabama.—In Escambia County, Stanolind Oil & Gas Co. has set production casing and is preparing to test its prospective discovery, 1 F. A. Steward, 11-1n-8e. According to electric log and side-wall samples, the rank wildcat held an estimated 12 ft. of saturated oil sands between 5,938-50 ft. A drill-stem test was conducted at 5,938-41 ft. using $\frac{5}{8}$-in. bottom and $\frac{1}{4}$-in. top chokes. Recovery was 15 ft. of oil, water cushion, 90 ft. of oil-cut mud, 115 ft. of oil-cuf brackish salt water, and 30 ft. of salt water. Additional coring toward total depth of 6,575 ft. failed to reveal additional shows. Shows encountered in this well are the best yet found in wildcat exploration this far east in Alabama.

Permian Basin

Sinclair Ellenburger Test Gets Good Oil, Gas Show

MIDLAND.—Sinclair Oil & Gas Co. 3-C June Tippett, important Ellenburger test northwest of the main Pegasus field, had casing set on bottom at 13,133 ft. and was preparing to drill plug, perforate, and test.

A 5-hour drill-stem test in the Ellenburger from 13,043-93 ft. had gas in 1 hour and 50 minutes and produced a good blow throughout the test. Recovery was the water blanket plus 3,980 ft. of high-gravity oil and 120 ft. of heavily oil and gas-cut mud with no water. Open-flowing bottom-hole pressure was 2,450 psi., and 30-minute shut-in pressure reached 4,950 psi.

Spartan Drilling Co. prepared to complete its 1-A Mary Scharbauer as a Pennsylvanian extension to the Parks field. Open hole from 10,620-40 ft. was treated with acid and the well kicked off when swabbed. In 20 hours it gaged 177 bbl. of oil.

West-central Upton County had a Wolfcamp discovery in the making at Greenbrier Oil Co. and others 1 Windham, 14,000-ft. Ellenburger exploration. Unofficial pay top has been placed around 9,040 ft. on elevation of 2,832 ft. Field sources credited the well with being low on the Wolfcamp to the Wilshire field discovery, $3\frac{1}{2}$ miles northwest. The Wolfcamp in the Wilshire well was nonproductive, however.

First test in the 1 Windham from 9,026-72 ft. had gas in 4 minutes and flowing oil in 51 minutes through $\frac{3}{4}$-in. bottom choke at an estimated 15 bbl. an hour. Bottom-hole flowing pressure ranged from 550-1,200 psi. Drill samples had good oil shows to 9,092 ft., and a test was run between 9,072-92 ft., but apparently the tester plugged.

It was drilled ahead and at last report a test from 9,092-9,122 ft. had oil at the top in 29 minutes and flowed at the rate of 30 bbl. an hour.

Atlantic Refining Co. 1 Calvin H. Sugg, northeast Reagan County Ellenburger failure at 10,285 ft., plugged back and completed as a Wolfcamp discovery. At last report it was flowing at the rate of 172 bbl. of oil a day through 27/64-in. choke from pay at 8,095-8,120 ft.

In Dawson County, Gulf Oil Corp. 1-Y Carrie S. Dean southwest of the Snowden Spraberry field prepared to deepen after recovering 70 ft. of gas-cut mud on a test of the Mississippian at 10,230-10,318 ft. It is on an Ellenburger contract.

Tide Water Associated Oil Co. 1 Stokes, 3 miles northwest of Welch, recovered 3,620 ft. of salt water on a drill-stem test in the Pennsylvanian reef at 9,633-9,729 ft. and was shut down for orders. Top of the reef was 9,605 ft.

Northeast of Midland, Blackwood & Nichols 1 Hofferkamp developed only 15 ft. of mud on a 30-minute test in the upper Pennsylvanian at 10,420-65 ft.

Deep Rock Oil Corp. 1 J. O. McCrary, Howard County wildcat north of Big Spring, sprayed oil, gas, and mud and recovered 720 ft. of 47°-gravity oil plus 450 ft. of heavily oil-cut mud on a test from 9,038-64 ft. It was cored ahead, recovering lime and

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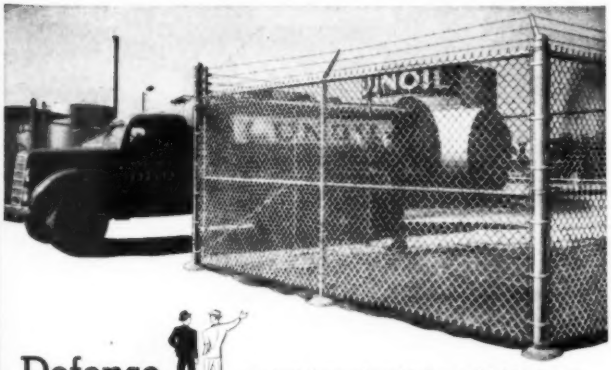

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shale with some porosity between 9,064-89 ft., and at last report was coring at 9,139 ft.

Cosden Petroleum Co. 1 McDowell, in southwestern Howard County, was drilling ahead at 8,595 ft. A drill-stem test from 8,490-8,521 ft. developed 35 ft. of oil. Tentative identification was the lower Wolfcamp.

WEST TEXAS (DISTRICTS 8 AND 7-C) SUCCESSFUL WILDCATS

Crockett County: Malco Refining Co. 1 Geo. Bean, 34-UV-GC&SF, TD 1,467 ft., elev. 2,571 ft., Grayburg pay 1,460 ft. IP: pumped 49.7 bbl. 28°-gravity oil a day.

Gaines County: Magnolia Petroleum Co. 1 Gertrude Chilton, Lge. 288, Gray CSL, TD 12,437 ft., elev. 2,991 ft., Pennsylvanian reef 11,323 ft., pay 11,334 ft., PB 11,500 ft. IP: pumped 472 bbl. 38°-gravity oil a day.

Reagan County: Amerada Petroleum Corp. 1 G. L. Aldwell, 16-C-L&SV, TD 7,037 ft., elev. 2,691 ft., Spraberry 6,805 ft. IP: flowed 128 bbl. 37°-gravity oil a day, ¾-in. choke, GOR 633 cu. ft., TP 50 psi.

Stanolind Oil & Gas Co. 1-A P. E. Wade, 213-2-T&P, TD 5,922 ft., elev. 2,658 ft., Spraberry 5,890 ft. IP: pumped 5 bbl. 37°-gravity oil.

Upton County: Ashland Oil & Refining Co. 1 B. Sherrod, 6-C-L&SV, TD 10,542 ft., PB 7,180 ft., elev. 2,716 ft., Spraberry 6,980 ft. IP: pumped 15 bbl. 37°-gravity oil.

James H. Snowden 1-1 Tippett, 1-M-HE&WT, TD 7,224 ft., elev. 2,733 ft., Spraberry pay 7,184 ft. IP: flowed 344 bbl. 38°-gravity oil in 12 hr., 40/64-in. choke, GOR 724 cu. ft., TP 550-150 psi.

WEST TEXAS (DISTRICTS 8 AND 7-C) WILDCAT FAILURES

Coke County: Norfitt Petroleum Corp. 1 D. S. Percifall, Caldwell CSL Sur., dry, TD 1,596 ft.

Crockett County: Continental Oil Co. 2-A Shannon, 22-UV-GC&SF, dry, TD 7,390 ft., elev. 2,620 ft., Spraberry 4,530 ft., Wolfcamp 5,760 ft., Ellenburger 7,240 ft.

Garrett M. Smith 1 J. M. Shannon, 4-BB-EL&RR, dry, TD 2,372 ft.

Gaines County: Cabot Carbon Co. 1 W. F. McFarlin, 302-G-CCSD&RGNG, dry, TD 5,449 ft., elev. 3,439 ft., San Andres 5,030 ft.

Charles B. Wrightsman 1 Will Terry, 9-A-28-PSL, dry, TD 8,422 ft., elev. 3,490 ft., Clear Fork 6,065 ft., Tubb 6,585 ft., Devonian 8,170 ft.

Glasscock County: Phillips Petroleum Co. 1 Woolsey, 26-36-2S-T&P, dry, TD 7,837 ft., elev. 2,661 ft., San Andres 3,730 ft., Spraberry 6,895 ft.

Howard County: Sunray Oil Corp. 1 J. H. Harper, 15-32-1N-T&P, dry, TD 9,505 ft., elev. 2,587 ft., Spraberry 5,875 ft., reef 8,835 ft., Mississippian 9,400 ft.

Kent County: Kewanee Oil Co. 1-1F Will Connell, 4-4-H&GN, dry, TD 7,433 ft., elev. 2,209 ft., Canyon 6,858 ft., Mississippian 7,398 ft.

Pecos County: Lario Oil & Gas Co. 1 C. J. Colden, 40-10-H&GN, dry, TD 6,790 ft., elev. 2,410 ft., Simpson 5,340 ft., McKee 5,580 ft., Ellenburger 6,500 ft.

Reagan County: Continental Oil Co. 1-3 University, 3-49-University Lands, dry, TD 9,775 ft., elev. 2,724 ft., Spraberry 5,235 ft., Ellenburger 9,624 ft.

Schleicher County: E. B. Fletcher 1 Mary Robinson, 39-I-GH&SA, dry, TD 6,216 ft., elev. 2,351 ft., Strawn 5,208 ft., Ellenburger 5,705 ft.

Tom Green County: L. E. Scherck 1 J. E. Kapavik, 6-4-Tom Green CSL, dry, TD 5,402 ft., elev. 1,870 ft., Strawn 4,708 ft., Ellenburger 5,372 ft.

Winkler County: General American Oil Co. 1 W. J. Richmond, 285-D-J. H. Gibson Sur., dry, TD 12,331 ft., elev. 3,787 ft., Pennsylvanian 10,160 ft., Devonian 12,290 ft.

SOUTHEASTERN NEW MEXICO

HOBBS—The Texas Co. 1-AT State, discovery prospect in 10-14s-33e, 4 miles north of the Saunders field and 2 miles from an extension well, flowed oil and water on a

drill-stem test from 9,805-55 ft. Following that, a 3½-hour test from 9,890-9,967 ft. had gas in 9 minutes and recovered 1,595 ft. of heavily oil and gas-cut mud estimated to be 75 per cent oil. Operators were running casing for completion.

Magnolia 1-B Santa Fe, a Crossroads field well but 1½ miles west of nearest production, set casing at 12,130 ft., 2 ft. into the Devonian and was waiting on cement.

Magnolia 1 Black, west of the Denton field, recovered a 1,400-ft. water blanket cut with oil and gas, and 330 ft. of heavily oil and gas-cut mud on a drill-stem test at 10,283-10,337 ft. It was coring ahead below 10,340 ft., in the Permo-Pennsylvanian.

Los Nietos Oil Co. 1 Elliott-Federal, wildcat in 27-11s-38e, topped the Mississippian limestone at 11,422 ft., minus 7,520 ft. and was drilling ahead at 11,430 ft. A 2-hour test in the bottom of the Pennsylvanian at 11,378-11,408 ft. recovered the water blanket and 10 ft. of drilling mud.

SOUTHEAST NEW MEXICO SUCCESSFUL WILDCATS

Eddy County: Miller Bros. Oil Co. 1 Jones-Watkins-State, 5-19s-29e, TD 2,785 ft., elev. 3,394 ft., San Andres 2,739 ft., pay 2,751 ft., IP: pumped 5 bbl. 36 -gravity oil.

Lea County: Skelly Oil Co. 1-J State, 32-24s-37e, TD 10,245 ft., elev. 3,180 ft., Ellenburger 10,135 ft., perforated 10,210-230 ft., IP: flowed 583 bbl. 42 -gravity oil a day, ¾-in. choke, TP 75 psi., GOR 352 cu. ft.

TEXAS PANHANDLE (DISTRICT 10) WILDCAT FAILURE

Oldham County: Superior Oil Co. 2 Matador, Lge. 312, 9 mi. N Landergin, dry, TD 6,177 ft., elev. 3,805 ft., Granite wash 6,165-77 ft., dolomite and shale 5,880-6,165 ft.

Southwest Texas

Best Gas Pay Yet Is Found In New Riverside Field Zone

CORPUS CHRISTI — Possibilities of the best gas-pay sand yet found in Riverside field, Nueces County, are indicated at Lockhart Oil Co. 7 E. C. Wilson, which flowed at the rate of 96,000,000 cu. ft. of gas daily on open-flow gage. The well was completed as a dual oil-gas well, with the new pay being opened at 4,617-29 ft. Oil flowed through perforations in the Wright sand at 4,921-25 ft. Other gas sections in the field have been at greater depths, generally around 4,800 ft.

New pay has been established in Plymouth field, San Patricio County, at Heep Oil Corp. E-14-F E. H. Welder, which flowed 143 bbl. of 40.4°-gravity oil daily through perforations at 6,830-32 ft. Top of the new pay was picked at 6,824 ft. The test was dually completed from casing perforations at 6,139-42 ft. Through these perforations flow was gaged at 103 bbl. of 39.9°-gravity oil daily.

Superior Oil Co. 27 Minnie S. Welder, San Patricio County wildcat, which established a drilling depth record of 17,691 ft. for the state of Texas several weeks ago, lost some of the footage after being forced to sidetrack around a defect in the protective casing at 16,123 ft. Well was sidetracked at 16,040 ft. and at last report was drilling at 16,366 ft.

A wildcat located 1½ miles southeast of Mustang Island field, Nueces County, has set 5½-in. casing at 8,579 ft. and is now waiting on cement. The test is Sam E. Wilson, Jr., Renwar Oil Corp. and Arkansas Fuel Oil Co. 1 State Tract 462-A. It is actually located on the flats on the edge of Mustang Island itself and is across the fault from Mustang production out in Corpus Christi Bay.

In Hagist Ranch field area of McMullen County, Argo Oil Corp. 1 H. F. Fagan tested gas and distillate in the top of the Wilcox and is now coring ahead. On 72-minute drill-stem test at 7,128-37 ft. using ¼-in. chokes, water cushion hit the surface in 14½ minutes and recovery was 450 ft. of water cushion and 45 ft. of distillate.

Humble Oil & Refining Co. has scheduled another deep wildcat in the southeast corner of Kenedy County. Test is 2 King Ranch-San Jose Parral and is located in Jose Parral pasture, 22½ miles northeast of Raymondville. Contract depth is 12,000 ft.

SOUTHWEST TEXAS (DISTRICTS 1 AND 4) SUCCESSFUL WILDCATS

Caldwell County: Oil discovery—Riddle Oil Co. 4 A. J. Miears, Nich Kelly Sur., TD 2,162 ft., open hole 1,980-81 ft., IP: 44 bbl. oil per day on pump, 39° gravity.

Starr County: Gas-condensate discovery—"Flores"—Sunray Oil Corp. 1 G. G. Zamora, Sec. 883, Flores Grant, TD 6,600 ft., Sullivan 4,366-79 ft., IP: 42,500,000 cu. ft. of gas daily plus 15 bbl. of distillate per M.M.c.f., SIP 1,716 psi.

SOUTHWEST TEXAS (DISTRICTS 1 AND 4) WILDCAT FAILURES

Atascosa County: C. C. Dauchy and Miller Royalty Co. 1 Francisca V. Luna, Donaciano de Luna Sur., Sec. 46½, A-1397, dry, TD 5,201 ft.

Stanolind Oil & Gas Co. 1 F. C. McKinney, H&GN Sur. 73, A-419, dry, TD 3,722 ft.

R. B. Wherry & C. A. Green 1 Quick, I&GN Sur., A-491, dry, TD 2,000 ft.

Bexar County: Traders Oil Co. of Houston 3 Antone Pfeil, E. Gartari Sur. 2, A-5, dry, TD 942 ft.

Duval County: Calvert, Cochran & Manley 1 Geo. Megerle, Joseph Broyles Sur., A-948, dry, TD 2,155 ft.

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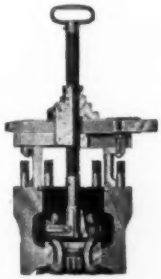

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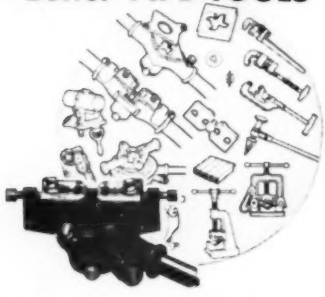

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Southern Minerals Corp. 1 P. C. Breckenridge, et al, Sec. 17, Copita Farm & Garden Tract, dry, TD 5,685 ft.

Frio County: G. R. Schimmel 1 A. E. Wilms, Henry Castro Sur. 96, A-194, dry, TD 2,910 ft.

Guadalupe County: G. D. Gurley 1 Mrs. Mabel E. Petty, Andrew Mitchell Lge., dry, TD 1,728 ft.

H. H. Weinert 1 Karl Lehmann, John Wells Sur., A-335, dry, TD 3,372 ft.

Hidalgo County: Continental Oil Co. 1 Esther E. Johnson, Turner Tract Subd., San Juan de Carricites Grant, dry, TD 10,004 ft.

Jim Hogg County: Sun Oil Co. 22 Well Bros., Sec. 468, HE&WT Sur., dry, TD 6,413 ft.

Kerr County: A. Edmiston 1-A Gus Shreiner, HE&WT Sur. 7, dry, TD 1,476 ft.

LaSalle County: R. L. Kirkwood & Morgan 1 T. A. Kerr, I&GN RR Sur. 21, Block 2, A-896, dry, TD 6,314 ft.

Milam County: Wilbur A. Brian 1 Virgil and Virginia Hyde, Rueben Fisher Sur., dry, TD 3,054 ft.

Nueces County: M. H. Major 1 Fern Helscher, Block 22, John J. Elliff Tract, dry, TD 7,504 ft.

Starr County: Sun Oil Co. 1 H. P. Guerra, et al, AB&M Sur. 145, dry, TD 6,002 ft.

Travis County: Terra-Mag 1 R. B. Thrasher, Amos Alexander Sur., dry, TD 1,095 ft.

Webb County: Boyce-Smiser-Runion Oil Co. 1 Lewis, HE&WT RR Sur. 460, dry, TD 2,605 ft.

Magnolia Petroleum Co. 3 Thos. Hetherington, Seale, Morris & Sale Sur. 491, A-491, dry, TD 1,090 ft.

Williamson County: M. B. Duke 1 Otto Brachmeyer, Peter Cartwright Sur., dry, TD 1,626 ft.

Sol Kopel 1 H. W. Sauer, T. W. Medcalf Sur., dry, TD 1,620 ft.

Neal Drilling Co. 1 C. C. Heine, William Byerly Sur., dry, TD 1,610 ft.

Appalachian-Ohio

Shallow Well Finds Production in Berea

PITTSBURGH. — In Ravenswood district, Jackson County, West Virginia, D. D. Foster 2 Mabel Hutchinson, resulted in a good oil well in the Berea sand with a daily initial of 50 bbl. at a total depth of 2,322 ft. In Trap Hill district, Raleigh County, Hope Natural Gas Co. 9667 Paul Trump, gaged 1,485,000 cu. ft. of gas in the Maxon sand, with total depth at 2,083 ft. In Holly district, Webster County, United Fuel Gas Co. 6761 Henry A. Brockerhoff is currently at a depth of 1,059 ft. It tested 440,000 cu. ft. of gas at this interval.

Maryland.—In Garrett County, Eberly & Snee 3 fee is running casing at 3,683 ft. Eagle Oil & Gas Co. plans to abandon its 1 Earl Ashby at 1,407 ft. on account of a bad fishing job. C. E. Young 1 F. Perry Smith, Jr. (elevation 2,575 ft.) topped the Onondaga at 4,905 ft. and is shut down to run casing at 4,930 ft. Mid Atlantic Oil & Gas Co. 1 Blair Simmons, elevation 2,480 ft., is shut down at 4,186 ft. with gas in the chert previously reported testing 184,000 cu. ft. This well will be shot.

Southern Pennsylvania.—In Unity Township, Westmoreland County, Peoples Natural Gas Co. 1,4003 A. J. Dotterway, new deep wildcat, has started drilling and is at a depth of 352 ft. In South Buffalo Township, Armstrong County, Pittsburgh Plate Glass Co. 2-839 Mary A. McGinley estate, is drilling at 4,974 ft.

OHIO

E. H. Everett Co., offsetting oil production, struck gas at 1 George Rankin, Lot 18, Hopewell Township, Licking County. The Clinton sand at 2,915-61 ft. gaged 890,000 cu. ft., natural, and the well was tubed without shooting.

Status Development Co. 1 A. T. Rice, Sec-

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. . . and I'd probably be there yet if I hadn't got interested in sellin' Web Wilson Oil Tools out in Texas. ★ You know, these Web Wilson Tongs and Elevators are so doggone safe and easy to handle that crews catch on right away I've done 'em a favor when I sell 'em! And, boy, there's no better way to make friends than that. ★ It's a funny thing too how many friends I've made with those "Tiger Tooth" Tong Dies which take hold right now and *just won't slip.* Makes me happy to have 'em when I think how good men get hurt when those old-style dies slip on a hard tool joint. ★ My name is Wm. J (Bill for short) Davis, and I'd sure like to have you call me at Wichita Falls 6-729 so we could sort of get acquainted.

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tion 26, Pike Township, Stark County, ½ mile extension to the field at Sparta, found the white Clinton at 4,716-74 ft. with an open flow of 500,000 cu. ft. of gas, natural, and a rock pressure of 1,310 psi.

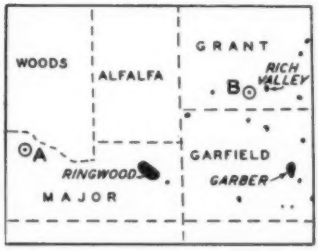
John Morrow et al., offsetting their oil discovery to the north, encountered gas and only a small show of oil in the 3 E. O. Rodehaver, second quarter, New Castle Township, Coshocton County. The Clinton at 3,153-3,210 ft. gaged 380,000 cu. ft. of gas, natural, and 1,000,000 cu. ft. 1 hour after a 90-qt. shot.

Clyde Foraker et al. have started drilling a wildcat on the 1 F. W. Tates, Lot 19, Monroe Township, Coshocton County. Roy Stewart et al. are drilling in the Niagara lime at a wildcat on the 1 Donald Crunkilton, Lot 3, Pike Township, Knox County.

Oklahoma

Another Wilcox Oil Pool Opened in Grant County

ANOTHER Wilcox pool is being opened in Grant County where Cummings-McIntyre and associates are making production tests in their 1 Combs, SE SE NE 6-25n-5w. Location (see map) is 1½ miles east of Pond Creek, in the south central part of the county, on the upper rim of the Harper embayment arm of the Anadarko basin, where exploration of Wilcox potentialities



Prospective discovery wells: (A) Cummings-McIntyre and associates 1 Combs, and (B) Sinclair Oil & Gas Co. 1 Campbell.

has paid off in a succession of good discoveries within the last several years. It is approximately 6 miles west of the Rich Valley and Southeast Rich Valley pools, the latter opened last June and in which 4 wells have been completed to date.

The new discovery is testing second Wilcox sand with hole open below 5,959 ft. to total depth at 5,982 ft. It logged the first Wilcox sand at 5,934-42 ft., the Marshall zone at 5,958-75 ft., and the second Wilcox from 5,975 ft. The well flowed at an estimated rate of 30 to 40 bbl. of oil per hour during the final 10 minutes of a 25-minute drill-stem test of an interval at 5,962-82 ft. Gas flow, starting 4 minutes after tester was opened, was estimated at 3,000,000 cu. ft. per day.

Sinclair Oil & Gas Co.'s interesting Anadarko basin wildcat in northwestern Major County (see map), is drilling ahead below 7,600 ft. in lime after passing up, for the time being, promising oil and gas showings (previously reported) found in the upper part of the Mississippian at 7,393-7,415 ft. This test is 1 Campbell, C NE NW 36-23n-16w. A drill-stem test of the above interval yielded 300 ft. of heavily oil and gas-cut mud. Hole probably will be carried to its projected depth objective of 9,100 ft.

Springer sand development in southern Oklahoma has resulted in another discovery at Stanolind Oil & Gas Co. 1 Mills, SE NE SE 17-2s-3w, 3 miles west of Fox,

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Carter County, which pumped 75 bbl. of 24°-gravity oil per day from casing perforations at 5,308-14 ft. with top of the pay at 5,300 ft. The location is midway between the Fox-Graham and Camp pools.

A 2½-mile southeastward extension of Springer production of the Fox-Graham pool is indicated by showings found in that horizon by Magnolia Petroleum Co. in its 9 Laham, SW NE NE 25-2s-3w. This well, 4 miles southeast of the new Stanolind discovery picked up the Springer at 6,539 ft. A series of drill-stem tests through the section from 6,606 ft. to 6,908 ft. got good recoveries of oil and oil-cut mud. The best test was of an interval at 6,735-89 ft., where 2,700 ft. of oil and 180 ft. of oil-cut mud was recovered. Hole is being drilled ahead below 6,935 ft.

Deeper exploration in the old Moore field, Cleveland County, has uncovered prospective production in McLish sand, in the lower part of the Simpson section. Present production in the field is from Wilcox sand. Sinclair Oil & Gas Co. 5-A Community Franklin, C NE SE 21-10n-2w, deepening from the Wilcox sand, topped McLish sand at 7,458 ft., and in a drill-stem test at 7,565-7,609 ft., flowed gas at an estimated rate of 1,250,000 cu. ft. per day and distillate at an estimated rate of 5 bbl. per hour. The breakdown yielded 180 ft. of distillate and 360 ft. of gas and mud-cut distillate. A previous drill-stem test of an interval at 7,494-7,531 ft. flowed gas and recovered 110 ft. of distillate. At a depth of 7,685 ft. the well continued to get showings.

OKLAHOMA SUCCESSFUL WILDCATS

Beckham County: Howell & Howell and Walter Duncan 1 Johnson-Reisner, C NE NE 11-10n-22w, flowed 185 bbl. 51°-gravity oil from Hoxbar conglomerate at 9,934-60 ft., TD 10,626 ft.

Okfuskee County: Wiser Oil Co. 1 J. F. Darby et al, NE SE NE 21-12n-8e, pumped 19 bbl. oil from Cromwell at 3,724-27 ft., TD 3,788 ft.

Osage County: Sunray Oil Corp. 1 Osage, NE NE NE 10-24n-4e, pumped 18 bbl. oil from Mississippi chat at 3,374-84 ft., TD 3,908 ft.

Pawnee County: Big Four Petroleum 1 H. Sinclair, SW NW SW 34-20n-8e, flowed 11 bbl. 38°-gravity oil from Bartlesville at 2,495-2,505 ft., TD; new pay in Lauderdale.

Pottawatomie County: Wood Oil Co. 1 Brandt, SE SE SW 18-10n-5e, pumped 25 bbl. oil from dolomite at 4,760-80 ft., TD.

OKLAHOMA WILDCAT FAILURES

Carter County: The Texas Co. 1 L. O. Majors, NE SE SE 19-1s-2w, dry, TD 5,063 ft., geological wildcat in Tatums.

Garvin County: Sohio 1 L. P. Shi, NE SW SE 31-4n-3e, dry, TD 3,545 ft.

Cities Service 1 Magee, C NW SW 23-4n-4w, dry, TD 8,551 ft.

Kingfisher County: Pure Oil 1 Pollard, SE SE NW 34-19n-5w, dry, TD 7,502 ft.

Kiowa County: W. F. Collins, SW NW NE 19-7n-16w, dry, TD 976 ft.

Lincoln County: B. I. Daniels 1 Evans, SE SE NE 14-15n-4e, dry, TD 3,802 ft.

Keystone and Larsco Drilling 1 D & D, SW SW NW 23-16n-3e, dry, TD 4,934 ft.

C. E. McCaughey et al 1 Brannon, NW NW SE 35-17n-2e, dry, TD 4,838 ft.

Flynn Oil 1 Terry, SW SW SE 14-12n-6e, dry, TD 4,696 ft.

Love County: Lewis 1 Campbell, NE SW SE 21-6s-2e, dry, TD 530 ft.

McClain County: Williams-Copeland 1 Fike, NE SW SE 33-5n-3e, dry, TD 3,701 ft.

Pawnee County: Deep Rock 1 Adler, NW SW NE 12-20n-6e, dry, TD 3,310 ft.

Stephens County: V. L. Crowell et al 1 Emeyabbi, NE SE NE 13-3s-4w, dry, TD 3,505 ft.

T. W. Fenton, Jr. et al 1 Dunning, NS N ENW 3-3s-7w, dry, TD 1,100 ft.

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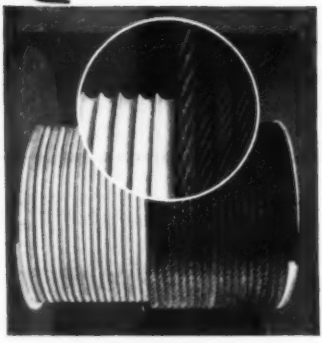

This photograph and insert is a drawworks drum with the LeBus Wire Line Grooving and Spooling System installed and with the first layer of line wrapped to the preferred pick-up point when coming out of the hole to change bits.

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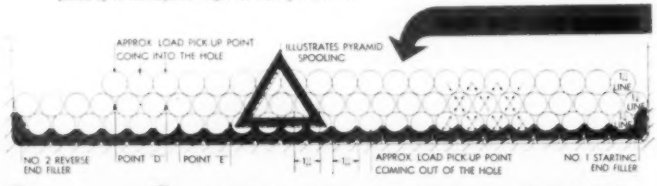
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Canadian Fields

New Production Tapped In Huge Williston Basin

CALGARY.—Shell Oil Co. has discovered 20°-gravity crude in the Mississippian dolomite at Shell-Dahinda 1, wildcat in southern Saskatchewan about 50 miles south-southwest of Regina. While the oil volume is not large, the discovery is of considerable importance because it marks the first recovery of crude oil in the south Saskatchewan portion of the great "Williston-Moose Jaw basin."

The Dahina well is located around 100 miles north of Amerada Petroleum Corp.'s important Devonian dolomite oil and gas discovery in the Tioga area of North Dakota, and about 175 miles west of California-Standard Co.'s Mississippian limestone oil discovery in the Virden area of southwest Manitoba. The Virden and Tioga discoveries, made earlier this year, marked the first recoveries of oil from the Williston basin (see page 281 this issue).

Located in LSD 6, 2-9-23w2, the well found production in fractured dolomite at 4,694-4,704 ft. Initial bailing tests gave oil at the rate of 25 bbl. daily, with no water. A 1,000-gal. acid treatment was then applied. Acid water and drilling fluid are still being returned with the oil, and it is not yet possible to estimate potential nor establish whether or not the well is cleaned out. Bailing operations are continuing.

Shell's discovery well was drilled to a total depth of 5,249 ft. and plugged back to the indicated pay zone level. Production string of 7-in. casing was set at 4,730 ft., and the pipe was perforated from 4,694-4,704 ft. for tests.

Raymond I. Smith, American oil operator, has discovered natural gas at his

third venture located on farmout lands from Sun Oil Co. in the Southesk area of southern Alberta. The new strike was made in the Lower Cretaceous at R. I. Smith-C.P.R. 3, wildcat located some 90 miles east-southeast of Calgary. It rated an estimated flow of 9,000,000 cu. ft. of gas daily.

The C.P.R. 3 is located in LSD 4, 22-20-15w4, about 8 miles southeast of Delhi-Socony-Countess 1, gas discovery well. A 30-minute drill-stem test was run of the Cretaceous interval at 3,103-19 ft. Natural gas flowed to the surface in 2 minutes, and reading exceeded 5,000,000 cu. ft. daily, with engineers estimating the flow rate at 9,000,000 cu. ft. daily. There was no water recovery. The hole will be cored and tested at 10-ft. intervals in the Cretaceous sands.

The second natural gas discovery made this week was chalked up by Canadian Gulf Oil Co. at its wildcat in the Ewand-Smoky Lake area, about 60 miles northeast of Edmonton and 38 miles northwest of Redwater field. The new strike is Gulf-Crown-Ewand 8, in LSD 8, 26-60-16w4. The first drill-stem test was run in the upper portion of the Lower Cretaceous at 1,754-1,819 ft., with the valve open for 15 minutes and then reopened for 45 minutes. Natural gas flowed to the surface in 4 minutes, and mud sprayed in 10 minutes. Maximum natural gas flow rate was estimated at 5,000,000 cu. ft. daily, and recovery was 1 ft. of drilling mud. A second test, 40 minutes in duration, was run from 1,799-1,819 ft. There was a steady air blow throughout the test, but no gas flow. Recovery was 10 ft. of mud, no water. Drilling is now continuing below 1,893 ft.

A third gas strike was made by Imperial Oil, Ltd., at an exploratory venture on the central plains of Alberta. The gas was found in the D2 Devonian zone, and rates over 2,000,000 cu. ft. daily were found during drill-stem tests of various sections in that horizon.

The new well is Imperial-Caslan 1, in LSD 2, 18-63-17w4, about 66 miles northeast of Edmonton and 38 miles northeast of Redwater field. It is 7 miles northeast of Imperial-Figure Lake 1, gas discovery, and about 8 miles south-southeast of the Amisk Lake gas discovery. Five D2 tests between 2,265-2,302 ft. gave gas flow rates ranging from 1,200,000-2,050,000 cu. ft. per day, with the last test showing a recovery of some oil-cut salty mud. Drilling is continuing below 2,316 ft.

CANADIAN SUCCESSFUL WILDCATS

Imperial-Sturgeon 1, LSD 6, 19-54-25w4, TD 5,844 ft., Lower Cretaceous oil discovery, on pump production.

Texaco-Glenevis 1-A, LSD 7, 35-55-4w5, TD 5,618 ft., Madison lime oil discovery, 96 bbl. daily.

Decalta-Transvaal-St. Paul 1, LSD 4, 21-58-8w4, TD 1,600 ft., natural gas discovery.

Sun - Albercan - Royalite-Highland Park 1, LSD 1, 12-29-2w4, TD 3,504 ft., natural gas discovery.

CANADIAN WILDCAT FAILURES

Gulf-R. Gridley 6, LSD 6, 14-34-20w4, TD 6,440 ft.

Delhi-Amcan-Castor 3, LSD 6, 36-37-14w4, TD 3,625 ft.

Sun-Phillips-Fleet 1, LSD 15, 29-37-12w4, TD 3,575 ft.

Gulf-E. T. Leake 2, LSD 2, 11-66-2w5, TD 5,000 ft.

Cal-Standard-Nisku 7-19, LSD 7, 19-50-26w4, TD 6,140 ft.

Oldman River 1, LSD 6, 5-12-13w4, TD 3,140 ft.

Amerada-Crown JF 1-11, LSD 13, 11-44-17w4, TD 4,787 ft.

EASTERN CANADA

CHATHAM, Ont.—In Bruce County, Ontario, a test drilled by George H. Rawlings for Bruce Oil & Gas Co. at Miller Lake northeast of Owen Sound has finished dry at the granite around 1,583 ft. Trenton limestone was topped around 1,000 ft. and showed only slight traces of gas in a muddy formation. Further drilling may be undertaken in the spring.

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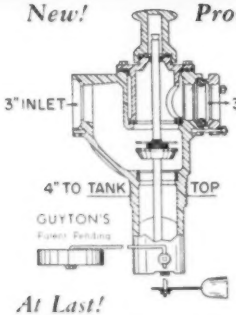

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Oil Ventures of Montreal has carried its Tar Point 1 to the maximum capacity of the drilling outfit, 6,125 ft. The test, started last December, was expected to get an oil zone in the top of the lime between 3,500 and 4,500 ft. At 4,118 ft., before it had reached the lime, light crude in fair quantities was encountered. Calcite in the formation indicated a fractured zone with the oil coming from a lower formation. Deeper drilling was undertaken, but at 6,125 ft. the drill was still in sandstone. There was no evidence of faulting. In the belief that an oil-bearing limestone is deeply buried, heavier equipment is being erected to continue the test.

On Galt Brook dome, roads have been built to the locations of five Continental-Gaspe wells. Continental Deep Test 1 has spudded and is below 600 ft. It is planned to bypass a green-crude horizon to reach a black asphalt-base oil zone expected between 4,000 and 8,000 ft. The discovery well on this structure, Continental-Gaspe 1, shut in all winter, built up heavy pressure and when opened gushed green crude through 2-in. pipe to near the top of the derrick. It has been again shut in, pending development of additional production from the four surrounding tests.

Quebec Oil 1, owned by Gaspe's associate, Quebec Oil Development, Ltd., has resumed operations on the Bald Mountain anticline and is drilling below 2,449 ft., with production expected around 2,500 ft. Gaspe Oil Ventures has spudded a second test on this structure.

Rocky Mountain

Discoveries and New Work Run High in West Nebraska

DENVER—Two new gas discoveries are apparent in the current wildcat drilling program through the Denver-Julesburg basin of Nebraska. E. Julian Davis (Davon Oil Co.) has cemented casing at the Northwest Peetz wildcat, 1 Olsen, C NE SW 17-12n-52w, Cheyenne County, Nebraska, after testing 2,500,000 cu. ft. of gas daily from the "J" sand between 5,375-83 ft. This wildcat is southwest of two gas producers in the same formation and southeast of a recent oil discovery by Wytex Petroleum of Houston and Derby Oil Co. of Wichita. C. D. Edmonson and Kansas-Nebraska Gas Co.'s wildcat at 1 Trollstrup Livestock, E½ NW NE 3-12n-43w, also found gas in the "D" sand on drill-stem test. This well is southwest of the same operator's Big Springs field, Deuel County, where five producing gas wells have been completed. In Kimball County Sinclair Oil Co. has tested oil in a possible new pay formation in Kimball field. The well is 1 Torgeson, SW NE NW 23-14n-56w, an offset to the recent "J" sand oil discovery by Nebraska Drillers. The Sinclair well tested some oil, heavily oil-cut mud, and oil and gas-cut water from the zone at 6,466-75 ft. Eight new wildcat locations were announced for the Denver-Julesburg basin of Colorado and Nebraska including one in Phillips County by Sunray Oil Corp., the first well in this basin for the company. Champlin Refining Co. also announced its first operation, a wildcat in Cherry County at 1 Hull, SW SW NW 11-29n-40w, along the top of the Chadron arch.

After testing oil from the Mississippian (Madison ?) at the Tioga, North Dakota, wildcat, Amerada Petroleum Corp. found water immediately below that zone and is coring ahead. The well, 1 Harry Bakken, C SW NW 12-157n-95w, flowed oil in 40 minutes on the test at 8,304-60 ft. last week, but on a test at 8,361-94 ft. the recovery was 1,700 ft. of sulfur water. This well is 12 miles north of the company's Devonian oil discovery at Beaver Lodge.

Shell Oil Co. has tested water from the Devonian at 1 Northern Pacific, SE NW NW 19-23n-50e, wildcat in the Richey area.

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It's amazing how a man can cover the oil fields in Illinois, Michigan, Indiana and Kentucky and still find time to eat and sleep. ★ This recent picture of C. B. (Bolivar) Holder proves that it can be done, with time out to sell a lot of Web Wilson Tongs, Elevators, Hooks and Links. ★ Even finds time to deliver "Tiger Tooth" Tong Dies right out of the back of his car to help fast-moving crews make-em-up and break-em-out safe and quick. ★ Why not phone him at Mt. Vernon, Illinois, 2042J (or drop a line to P. O. Box 493)? ★ See for yourself that he really "gets around fast".

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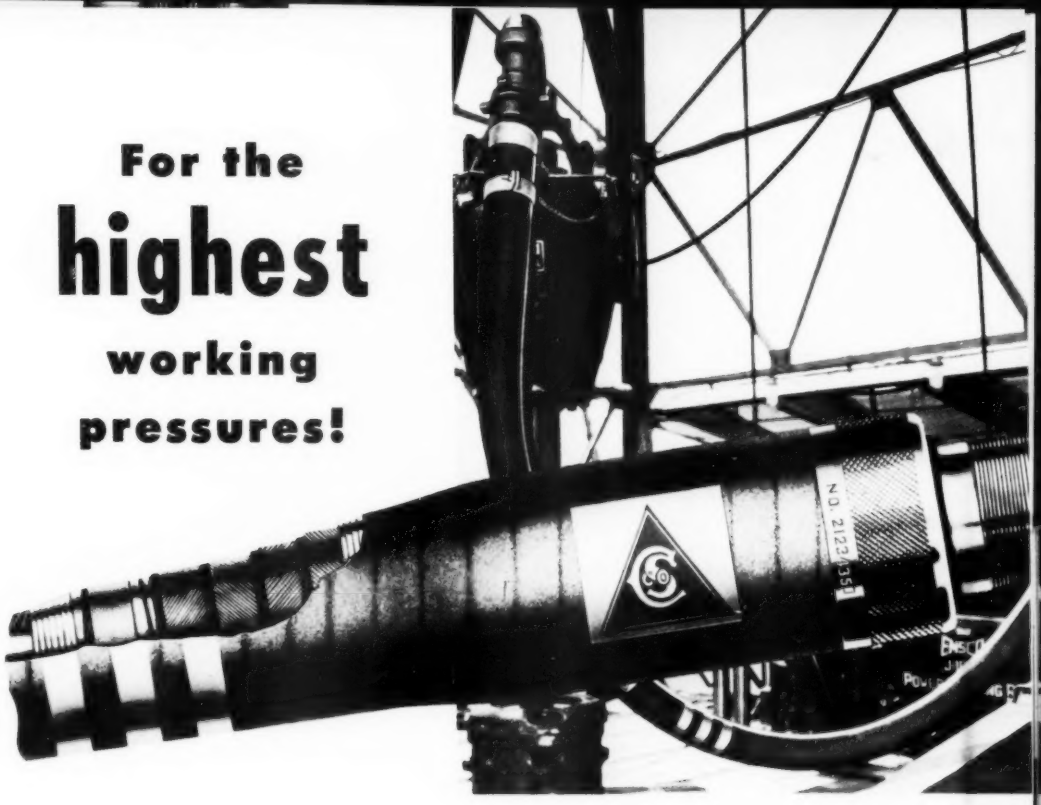

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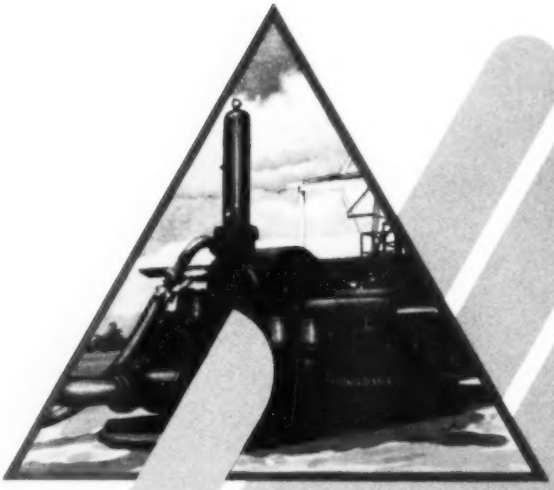

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Dawson County, Montana. The 64-minute test at 8,577-8,658 ft. made 2,500 f., of muddy salt water. Shell is coring ahead on the well, which flowed oil on tests of the Charles (?) in the Mississippian.

In Wyoming, Seaboard Oil Co. recovered gas with some oil-cut mud on tests of the Frontier at 1 State Unit, NE NW SW 16-56n-98w, wildcat in the Whistle Creek area, Park County. The Frontier was topped at 2,695 ft. and successive tests in the formation showed as much as 3,500,000 cu. ft. of gas daily from that formation. Shows of oil and heavily oil-cut mud were also recovered in zones down to 3,214 ft. The wildcat is between Garland and South Elk Basin fields, both of which have Frontier formation production.

Also in Wyoming, Phillips Petroleum Co. will drill 1 Unit, C SE NE 20-37n-75w, Werner Unit. This well is planned as a deep test on the south side of the Powder River basin in the area east of newly developed production at Glenrock. Sinclair Oil Co. has made location for a 9,000-ft. stratigraphic test in the East Cole Creek area at 1 Smith, SE SE NE 23-35n-77w. Carter Oil Co. will drill 1 State-Burke, Ranch, SW SE SE 36-37n-79w, Natrona County, as another of the series of tests along the southwest side of the Powder River basin.

There were 12 new locations in Colorado with the Lario Oil & Gas Co. 1 Blessing SE SW NE 10-1s-54w, in the Blessing area, Washington County, of interest. Plains Exploration Co.-McDermott and Barnhart will drill another of their series of Denver-Julesburg basin tests at 1 State, SE SE SE 16-8n-54w, in the southwest Yenter area.

SUCCESSFUL COLORADO WILDCAT

Springdale area, Logan County: Shell Oil Co. 1 State "B," SW NE NE 16-8n-53w, TD 5,346 ft., PB 4,905 ft., 5½-in. casing 4,969 ft., perf. 4,884-87 ft., flowed 38 bbl. oil, 55 bbl. water, 6,700,000 cu. ft. gas daily.

COLORADO WILDCAT FAILURE

North Yuma, Yuma County: Lion Oil Co. 1 Chrismer, SE SW SE 2-2n-48w, TD 6,779 ft., dry.

WYOMING WILDCAT FAILURES

Republic Unit, Big Horn County: Pure Oil Co. 1 Unit, NW NE SE 10-50n-91w, TD 4,532 ft., dry.

West Meadow Creek, Johnson County: Sinclair Oil Co. 1 West Meadow Creek Unit, SW NW SW 5-41n-27w, TD 7,670 ft., dry.

MONTANA WILDCAT FAILURE

Fowler area, Pondera County: Pacific Western Oil Co. 1 McCracken, C NE NE 18-29n-1w, TD 2,057 ft., dry.

WESTERN NEBRASKA WILDCAT FAILURES

Johnson area, Cheyenne County: Perl Smith 1 Dike, NW NW SE 7-14n-48w, TD 4,750 ft., dry.

Lieber area: Ohio Oil Co. 1 Lieber, NW NE NE 2-15n-50w, TD 5,235 ft., dry.

Morrill County: Rock Hill Oil Co.-Twin Oil Co. 1 Siemers, NW SE NE 2-17n-49w, TD 4,442 ft., dry.

Central Area

ILLINOIS

Opening of a new pool in the area about 4 miles southeast of West Salem in Wabash County is virtually assured by initial production tests by Gilliam Drilling Co. at its 1 Miller, NE NW SW 25-1n-14w. The well, located 3 miles from any other production, the nearest being in the South Lancaster pool to the northeast, flowed 168 bbl. of clean oil in the first hour after drilling plug. Production is from O'Hara lime at 2,840-44 ft. The area is 9 miles northwest of Mt. Carmel.

O'Hara lime also is the pay zone of another new pool being opened 5 miles southwest of Omaha in northern Gallatin County. Discovery well is Inland Producers 1 Allen, SE NW SW 8-8s-8e, which flowed initially at the rate of 15 to 20 bbl. of oil per hour. Production is from casing perforations at 2,863-68 ft. Total depth is 3,017 ft. with casing at 2,918 ft. Location is 1½ miles southwest of the Omaha pool, nearest production.

Five miles east of Omaha and about a mile southwest of production of the Herald pool, Sam B. Griffith and Nathan Berkman have run casing for production tests at their 1 Hale, SW NW NE 21-7s-9e, an indicated Cypress sand discovery. Saturation was logged at 2,605-20 ft. and a 2-hour drill-stem test of the interval got a gas flow in 90 minutes and yielded 160 ft. of clean oil in the breakdown. Casing was run to the top of the pay.

The Texas Co. 1 Tonn, NE SE NE 9-6n-5e, west offset to the same company's 1 Sinnickson, newly completed Rosiclare lime discovery well 2 miles north of the Mason

Manhattan

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That's a good word to describe H. E. (Herb) Maland who is with R. J. Eiche and Associates in Suite 314 at 30 Church Street, New York. ★ He has good "merchandise" for sale—knows that "merchandise" from A to Izzard—is serious, courteous and possessed of a high I.Q. ★ You would expect just such a person to be selling Web Wilson Tongs, Elevators, Links, Hooks and other oil tools—and that's *exactly* what he is doing. ★ If you are ever interested in drilling or production tools, why not telephone Worth 4-3980 and talk things over with Maland the "Merchandiser"—it might prove of mutual benefit.

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pool, looks like it will make a goood McClosky well after passing up the Rosiclare zone. Total depth is 2,545 ft. with casing cemented on top McClosky saturation at 2,540 ft. A 2-hour drill-stem test got a gas flow in 55 minutes and recovered 1,400 ft. of clean oil and 80 ft. of oil-cut mud. The well checked the Rosiclare at 2,417 ft. The Sinnickson well produces from this zone at 2,364-2,422 ft. The same company's 1 Martin, SW NW NW 10-6n-5e, north offset to the Sinnickson well, is another indicated McClosky well with casing run to 2,445 ft. to test saturation logged at 2,484-90 ft. Total depth is 2,500 ft.

INDIANA

A new pay zone, Cypress sand, has been established for the Huntington pool, Dubois County, by the completion by Dale Drilling Co. of its 2 Mehne, SW NE SE. The well pumped 25 bbl. net oil with 25 bbl. of water per day. The pay is at 836-54 ft., where 5-in. liner, run to bottom, is perforated. The pool, located 2 miles southwest of the town of the same name, was opened last February with gas production from Jackson sand below 600 ft.

WESTERN KENTUCKY

Iley B. Browning & Sons have an indicated McClosky lime well at their 2 Cottingham, 19-N-23, in the Knob Lick pool, Webster County. Other wells in the pool produce from the Waltersburg, Tar Springs and Hardinsburg sand, with best production from the latter. The McClosky pay in the Browning well is at 2,635-54 ft., where a drill-stem test showed gas in 1 minute and flowed clean oil in 15 minutes. Oil showings also were found in the Hardinsburg sand at 2,067-89 ft., opposite which interval an alloy section has been run in the casing string, run through the McClosky zone. Total depth is 2,700 ft.

EASTERN KENTUCKY

In Martha pool of northwestern Johnson County, Ashland Oil & Refining Co. is drilling at 469 ft. in the Big lime formation at 31 William Lester on Keaton Branch. The same company is drilling at 342 ft. on 34 William Lester. Both wells are in-fill drilling to the Weir (Mississippian) sand.

In the Kott County sector of Big Sandy gas field, Kentucky-West Virginia Gas Co. has completed a good gas well at 6000 George Gibson. Located on Little Carr Fork, the well tested 2,373,000 cu. ft. of gas daily from the Mississippian (Big lime) section at 2,334-2,539 ft., total depth.

In Elliott County, Isonville pool area, Logan Branch Oil Co., completed 1 J. A. Phillips for 2 bbl. of oil per day from the Weir sand at a total depth of 948 ft.

MICHIGAN

Superior Oil Co. was testing a Traverse oil pay at 2,080 ft. this week at the 1 Williams, NW NW NE 35-16n-15w, Colfax Township wildcat, Oceana County, after hole had been drilled out dry in the Dundee-Reed City zones at 2,702 ft., total depth. The well was plugged back to Traverse, jet perforated, and acidized.

Top of Traverse was logged at 2,025 ft. Pays were perforated with 48 shots from 2,028-47 ft. This opened section was acidized with 200 gal. Well showed 43 bbl. of oil in 3 hours on swab-test after acid treatment, but most of this recovery was believed to be load oil used in acidizing. Further testing was in progress.

Socony-Vacuum Oil Co. reported that its second Detroit River sour-zone oil producer in Billings Dundee oil pool, Gladwin County, was flowing natural at the rate of 87 bbl. of oil a day. Well was reported to be flowing by head every 4 hours with an average flow per head of 20 bbl. This well will be acidized.

The Socony sour-zone producer, 1 Pierson, NE NW NW 11-17n-1e, was bottomed out in this lower objective at 4,082 ft. Pay showed at 4,068-82 ft. Company has announced a new location on the same lease at the 2 Pierson, SW NE NE 11-17n-1e.

ILLINOIS SUCCESSFUL WILDCATS

Clay County: Calvert Drilling, Inc., 1 Gallagher, NE NW SE 13-2n-8e, IP 82 bbl., Rosiclare 3,003-08 ft., TD 3,071 ft., (opens new pool).
Clinton County: A. M. Foley 1 fee, W½ NW NW 21-1n-3w, IP 10 bbl., Devonian 2,479-90 ft., TD 2,490 ft.
Hamilton County: N. V. Duncan 1 McGill, W½ SE SW 4-6s-6e, IP 60 bbl., McClosky 3,200-11 ft., TD 3,234 ft.

ILLINOIS WILDCAT FAILURES

Bond County: T. M. Conrey 1 Dagit, NE SE NE 31-4n-3w, dry, TD 1,095 ft.
Crawford County: Dome-Minnick Oil Co. 1 Reynolds, SW SW NE 4-8n-12w, dry, TD 2,868 ft.
Edwards County: Calvert Drilling, Inc., and W. Duncan 1 Rice, SW SE NW 16-1s-14w, dry, TD 3,148 ft.
Fayette County: D. H. Bolin 1 Winter, NE SE SE 13-7n-3e, dry, TD 2,140 ft.
Gallatin County: G. L. Reasor 1 Henry et al, SW SW SW 15-9s-10e, dry, TD 2,737 ft.
Hamilton County: C. E. Brehm 1 Tolly NW NW NE 6-4s-7e, dry, TD 3,459 ft. J. V. Howell 1 Johnson, SW NW NE 15-7s-6e, dry, TD 3,323 ft.
Lawrence County: Arvin Drilling Co. and Aurora Gasoline Co. 1 Highsmith heirs, NW NW SW 3-2n-11w, dry, TD 1,952 ft.
Wabash County: Inland Producers 1 Lovelette, SE SE NE 10-2s-13w, dry, TD 2,797 ft.
Washington County: William Ford 1 Vejman SE NW 13-4s-2w, dry, TD 1,336 ft.
Wayne County: N. V. Duncan et al 1 Johnson, NW SW NE 17-2s-9e, dry, TD 3,474 ft.
White County: A. J. Walker 1 Cochran-Borst, SE NE NE 30-5s-14w, dry, TD 3,152 ft.

INDIANA SUCCESSFUL WILDCATS

Dubois County: Dale Drilling Co. 2 Mehne, SW NE SE 8-3s-5w, IP 25 bbl., Cypress 836-54 ft., TD 854 ft. (new pay zone Huntingburg pool).
Knox County: Cline & Lambert 1 Drieman.

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waiting for?

There *you* are with a well to dig as fast and as safe as you can—and here *I* am with the world's best tongs, elevators, links and hooks. So, what are we waiting for? We ought to get together *pronto* and do the job right! ★ You can tell at first glance that Web Wilson Oil Tools are what every fast-moving, safety-minded crew has been hoping for—and I can refer you to plenty of smart oil men who wouldn't use anything else. ★ If I don't get to you first, why not call me at New Iberia 155—the name is Johnny Deaver—and we've got a lot of things to talk over.

Military Donation 178-2n-9w, IP 15 bbl., Rosiclare 1,647-50 ft., TD 1,667 ft., (extension Monroe City West pool).

INDIANA WILDCAT FAILURES

Daviess County: Gopher Drilling Co. 1 Wonder, SE NE NW 33-2n-7w, dry, TD 1,616 ft.

Floyd County: B. Stoll 1 Scherzinger, SE SW SE 16-3s-6e, dry, TD 1,730 ft.

Jackson County: Albert Seevers 1 Hallow, SE NE NE 27-6n-5e, dry, TD 400 ft.

Knox County: G. C. Schoonmaker 1 Johnson, Location 14-1n-10w, dry, TD 2,103 ft.

S. Horan 1 Stewart, NE NE NE 31-2n-8w, dry, TD 1,648 ft.

Marshall County: W. E. Adams 1 Dewalt, SW NE NE 36-34n-2e, dry, TD 802 ft.

C. W. Kendall 1 Snyder, NE SE SW 6-34n-1e, dry, TD 454 ft.

C. A. Perry 1 Gorell, SE SE SE 29-35n-3e, dry, TD 435 ft.

Posey County: Indiana Farm Bureau 1 Armbruster, SE NE SW 9-7s-13w, dry, TD 2,781 ft.

Gilliam Drilling Co. 1 Duckworth, SW NE SE 27-7s-14w, dry, TD 2,722 ft.

Vanderburgh County: Wayne Meisner 1 Martin, NW SE NE 19-4s-10w, dry, TD 2,376 ft.

Ryan & Sharp 1 Hasenour, NE NW NW 24-1s-11w, dry, TD 2,457 ft.

Maynard Rogers 1 Craul Community, SW SE NW 25-5s-11w, dry, TD 2,435 ft.

Vigo County: Fortner-Compton 1 McHugh, SW SW NW 34-10n-10w, dry, TD 1,800 ft.

WESTERN KENTUCKY SUCCESSFUL WILDCATS

Henderson County: George S. Engle 1 W. T. Posey, N½ SE NE SW 14-P-23, IP 15 bbl., McClosky 2,594-99 ft., TD 2,601 ft. (discovery well Henderson South pool).

Joe Reznick 1 Farley, NL NE SW SE 15-Q-25, IP 130 bbl., O'Hara 2,319-24 ft., TD 2,325 ft. (discovery well Baskett pool).

MICHIGAN SUCCESSFUL WILDCAT

Allegan County, Heath Township: Ford Oil Co. 1 Slotman, SE SW SE 20-3n-14w, Traverse 1,401 ft., 2 bbl. oil and 2 bbl. water, TD 1,404 ft.

MICHIGAN WILDCAT FAILURES

Kent County, Sparta Township: P. K. Degenther 1 Frick, NE NW NE 16-9n-12w, Traverse 2,305 ft., dry, TD 2,310 ft.

Missoukee County, Norwich Township: Superior Oil Co. 1 Lyon, SE SE SW 30-24n-5w, dry in Richfield, TD 4,687 ft.

Louisiana-Arkansas

Rapid Development Seen For New Two-Parish Area

SHREVEPORT.—A new pool, designated as East Bellevue, has been opened by Skelly Oil Co. 1 E. L. Stewart, which flowed at the rate of 250½ bbl. of 31.1°-gravity oil per day. The well, located 466 ft. from the south and west lines of the southwest quarter, Section 19-19n-10w, Webster Parish, produces from three intervals in the Pettit lime at 3,978-86 ft., 3,990-98 ft., and 4,006-10 ft., and was drilled to 7,780 ft. in the Cotton Valley. It was plugged back and 7-in. string set at 4,188 ft.

Two outpost tests and two new locations are spotted in the area. Pan American Production Co. is below 2,690 ft. at 1 McCloud, across the boundary in Bossier Parish, NE NE NE 13-19n-11w. In Section 7-19n-10w, Webster Parish, Halsey & Stewart 1 Crichton-Bellevue continues drilling below 2,250 ft. Skelly has staked a southwest diagonal offset to the discovery at 1 J. T. Wurtsbaugh, 466 ft. from the north and east lines of Section 25-19n-11w in Bossier Parish. The same company will drill another offset at 2 E. L. Stewart, 2,000 ft. north and 2,025 ft. east of the southwest corner of Section 19-19-10w.

In the same parish, the first well on the Barksdale Air Force Base lease has been brought in for 120 bbl. of 41°-gravity oil per day. Production is from the Hosston sand at an approximate depth of 3,020 ft. The new well is Natural Gas & Oil Corp. and C. H. Murphy 7 USA, SW SW SE 12-17n-12w. Operators are testing at the 6 USA, SE SE SW, same section, and drilling is under way at the 1, 2, and 3 wells, two in Section 12 and one in Section 6.

Pay has been confirmed at Pool Lake field, Catahoula Parish, by Pan-Am Southern Corp. et al 4 Gillis heirs. This well flowed 61 bbl. of 38.2°-gravity oil from a Wilcox interval at 4,591-94 ft. Site is in 15-8n-7e. Total depth is 5,232 ft., plugged back to 4,652 ft.

A second attempt to confirm pay in the North Shongaloo area extending from Webster Parish into Section 11-20s-22w, Columbia County, Arkansas, has failed. McAlester Fuel Co. found the Pettit lime disappointing at its A-1 Pine Woods Lumber Co., SW SE 3-20s-22w, and stopped operations at 6,004 ft. Stanolind Oil & Gas Co. (opener of the extension area in Arkansas at its 1 Pine Woods) drilled the first failure, 2 Pine Woods in 10-20s-22w.

Another Columbia County wildcat is continuing drilling near 4,500 ft. The venture, McAlester A-1 Gean, 1,901 ft. east and 731 ft. north of the southeast corner of Section 6-17s-20w, had a show of oil in samples from the Pettit around 4,416 ft., and a slight show in a core from 4,020-23 ft.

In Union County, 1½ miles northeast of Bear Creek field, McAlester got a good pumping well at B-1 Southern Co., 4-16s-17w. Production is 114 bbl. of oil per day (2 per cent salt water) from the Travis Peak at 3,780-89 ft.

NORTH LOUISIANA WILDCAT FAILURES

Caddo Parish: D. C. Carnes et al 1 Hardeman, 150 ft. N and 1,182 ft. E SWc 18-22n-14w, dry, TD 2,880 ft.

Catahoula Parish: Baird et al 1 Lunn, Calhoun and Cady, 1,780 ft. N and 660 ft. W SEc 32-6n-7e, dry, TD 6,699 ft.

DeSoto Parish: McDowell & Cook, Inc. 1 Moncrief AA," SE SW NE 31-13n-15w, dry, TD 3,250 ft.

LaSalle Parish: Natural Gas & Oil Corp. 6 Urania Lumber Co., 1,798 ft. S and 443 ft. W NEc 4-10n-2e, dry, TD 3,502 ft.

Red River Parish: Kenilworth Oil Corp. 1 Long Bell Lumber Co., 360 ft. N and 1,550 ft. E SWc 26-13n-8w, dry, TD 3,504 ft.

Sabine Parish: Skelly Oil Co. 1 Frost-Sabine, C SE 16-9n-14w, dry, TD 7,304 ft.

ARKANSAS SUCCESSFUL WILDCAT

Union County: Herbert Herff et al (formerly National Associated Petroleum Co.) 2 Annie Smith, NE NE NE 17-16s 17w, pumped 120 bbl. oil from Travis Peak at 3,916-22 ft. and 3,924-30 ft., TD 6,395 ft., old dry hole worked over, new pay in Bear Creek.

ARKANSAS WILDCAT FAILURE

Ouachita County: S. J. Carnes 1 Berg-Bowers, C NE SW 24-13s-17w, dry, TD 2,719 ft.

Pierce Is Named to Top Executive Post

William B. Pierce has been elected a vice president of Allegheny Ludlum Steel Corp.

Pierce joined Allegheny in 1945 as manager of the sales development and engineering service department, and he was named technical director in December 1950, when he was given responsibility for research and metallurgical activities. He will retain that position as a vice president. He was formerly associated with Rustless Iron & Steel Corp. as sales manager and later as manager of development.

Stone Is Named to New Quincy Post

Harold Stone has been appointed manager of the St. Louis office and sales territory for Quincy Compressor Co., having been transferred from the company's New York office. He has also served as a member of the staff at the office and factory in Quincy, Ill.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Washington 25, D. C. Notice is hereby given that two tracts of land totaling approximately 135 acres in T. 19 S., R. 15 E., M.D.M., California, within the known geologic structure of the Coalinga East Side field, will be offered for oil and gas leasing, through competitive bidding to the qualified bidders of the highest cash amounts per acre, at 1 p.m., Eastern Standard Time, October 10, 1951, when bids will be opened. The details of the lease offering and how and where to file bids may be obtained by addressing an inquiry to the Land Office at Sacramento, or to this office. Marion Clawson, Director.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Washington 25, D.C. Notice is hereby given that four parcels of land totaling approximately 1,00 acres in T. 20 S., R. 34 E., N.M.P.M., New Mexico, within the known geologic structure of the North Lea field, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre, at 1 p.m., Eastern Standard Time, on October 10, 1951, when bids will be opened. Details of the lease offering and how and where to file bids may be obtained by addressing an inquiry to the Manager of the Land and Survey Office, at Santa Fe, New Mexico, or to this office. Marion Clawson, Director.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Washington 25, D. C. Notice is hereby given that 360.01 acres in Ts. 11 and 12 N., R. 97 W., 6th P.M., Colorado, within the known geologic structure of the Powder Wash field, will be offered for oil and gas leasing in two parcels, through competitive bidding to the qualified bidder of the highest cash amount per acre, at 1 p. m., Eastern Standard Time, September 26, 1951, when bids will be opened. Details of the lease offering, how and where to file bids, and a description of the lands may be obtained by addressing an inquiry to the Land and Survey Office, Denver, Colorado, or to this office. Marion Clawson, Director.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGEMENT, Washington 25, D.C., Notice is hereby given that the SE¼NW¼ sec. 28, T. 24 S., R. 38 W., 6th P. M., Kansas, 40 acres, within the known geologic structure of the Hugoton gas field, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre at 1 p. m., Eastern Standard Time, September 26, 1951, when bids will be opened. The details of the lease offering and how and where to file bids may be obtained by addressing an inquiry to this office. Marion Clawson, Director.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Washington 25, D.C. Notice is hereby given that the E½ lot 7, E½ and SW¼ lot 10, and S½ lot 11 sec. 18, T. 9 N., R. 78 W., 6th P.M., Colorado, within the known geologic structure of the North McCallum field, will be offered in one parcel for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre, at 1 p.m., Eastern Standard Time, September 26, 1951, when bids will be opened. Details of the lease offering and how and where to file bids, may be obtained by addressing an inquiry to the Manager of the Land and Survey Office, Denver, Colorado, or to this office. Marion Clawson, Director.

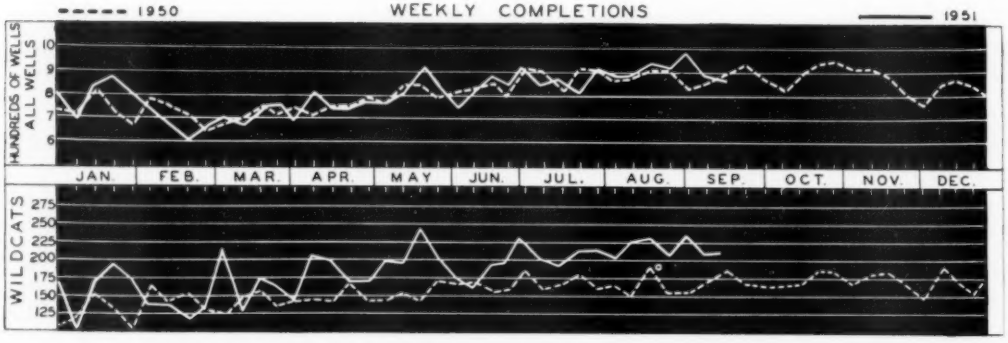
CURRENT STATISTICS

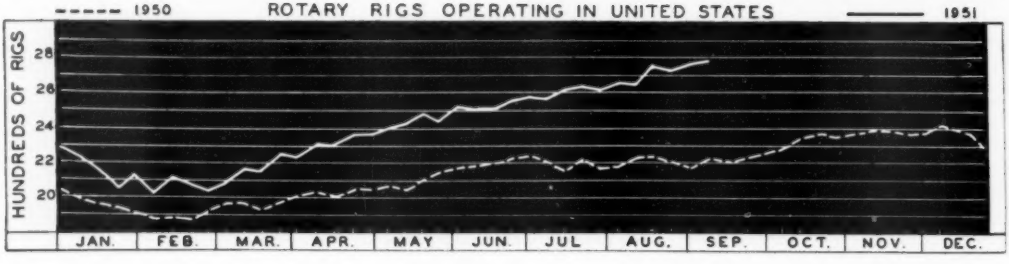
EXPLORATION

WEEKLY WELL COMPLETIONS . . . WEEK ENDED SEPTEMBER 15, 1951

	Total of all wells					Sept. 15		Wildcat completions and discoveries					Cumulative total, 1951				
	Comp.	Oil	Gas	Dry	Footage	1951	1950	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
New York	17	9	0	*8	24,599	453	493	0	0	0	0	0	0	0	0	0	0
Pennsylvania	40	22	7	†11	77,841	1,009	948	0	0	0	0	0	0	0	0	1	1
West Virginia	13	2	7	4	35,279	399	475	0	0	0	0	0	0	0	9	6	15
Ohio	23	8	3	12	37,205	667	701	0	0	0	0	0	1	0	5	16	22
Indiana	41	8	3	30	70,674	893	1,122	2	0	0	14	16	34	0	1	245	280
Kentucky	25	6	5	14	47,519	841	779	2	0	0	0	2	19	0	1	112	132
Illinois	42	18	0	24	114,778	1,670	1,938	3	0	0	12	15	55	0	0	385	440
Michigan	12	8	0	‡4	31,663	549	619	1	0	0	2	3	17	0	7	208	232
Kansas	74	31	0	§43	253,956	3,089	2,703	2	0	0	17	19	151	1	12	624	788
Nebraska	3	0	0	3	14,427	163	71	0	0	0	3	3	6	0	1	81	88
Oklahoma	101	56	2	43	327,129	3,969	3,828	5	0	0	14	19	135	3	16	510	664
Texas	322	192	9	121	1,472,845	11,768	11,561	14	2	1	85	102	520	40	85	2,430	3,075
North Central (Dist. 7-B & 9)	85	38	0	47	274,090	3,561	3,486	4	0	0	35	39	249	2	12	1,034	1,297
West (Dist. 7-C & 8)	98	75	2	21	560,911	3,559	3,485	6	0	0	13	19	128	9	6	457	600
Panhandle (Dist. 10)	10	4	3	3	32,301	497	637	0	0	0	1	1	2	0	0	17	19
Eastern (Dist. 5 & 6)	23	17	0	6	99,063	861	829	0	0	0	1	1	9	6	0	170	185
Gulf Coast (Dist. 2 & 3)	47	27	2	18	293,434	1,630	1,632	3	1	1	13	18	67	15	43	339	464
Southwest (Dist. 1 & 4)	59	31	2	26	213,046	1,660	1,492	1	1	0	22	24	65	8	24	413	510
Louisiana	52	26	4	22	317,187	1,482	1,724	0	2	1	8	11	30	8	6	200	244
Northern	31	15	2	14	115,489	802	925	0	0	0	6	6	8	0	3	120	131
Southern	21	11	2	8	201,698	680	799	0	2	1	2	5	22	8	3	80	113
Arkansas	8	5	0	3	27,400	282	292	1	0	0	1	2	11	0	3	58	72
Mississippi	0	0	0	0	0	238	230	0	0	0	0	0	11	3	0	92	106
Southeastern States	0	0	0	0	0	36	46	0	0	0	0	0	0	0	0	15	15
Montana	2	0	0	2	7,830	145	175	0	0	0	1	1	0	0	0	33	33
Wyoming	8	5	0	3	35,967	515	408	0	0	0	2	2	7	0	1	74	82
Colorado-Utah	6	3	0	3	29,890	190	55	1	0	0	1	2	7	0	4	89	100
New Mexico	19	11	6	2	98,957	450	437	2	0	0	0	2	15	0	7	50	72
California	57	40	1	16	229,655	1,602	1,263	1	0	1	10	12	33	0	3	320	356
Miscellaneous	0	0	0	0	0	53	37	0	0	0	0	0	1	0	19	17	37
Total United States	865	450	47	368	3,254,801	30,463	29,905	34	4	3	170	211	1,053	55	180	5,566	6,854
Total previous week	892	510	58	324	3,429,796			31	1	3	172	207	1,019	51	177	5,396	6,643
Total September 15, 1950	898	485	48	365	3,338,005			17	0	7	159	183	780	53	144	4,467	5,444

Service wells included *8, †9, ‡2, §1





DAILY AVERAGE PRODUCTION FOR WEEK

	Sept. 15 crude oil	B. of M. Sept. demand	Sept. 8 crude oil
Alabama	2,850	2,400	2,850
Arkansas	76,350	84,000	76,100
California	981,700	975,000	980,400
Colorado	77,700	77,000	77,800
Eastern	58,000	62,000	59,250
Florida	1,675	1,600	1,675
Illinois	167,400	160,000	167,500
Indiana	30,000	29,000	31,300
Kansas	307,450	320,000	312,450
Kentucky	31,300	29,000	32,000
Louisiana	627,250	668,000	626,700
North Louisiana	114,350		113,800
South Louisiana	512,900		512,900
Michigan	37,300	40,000	36,400
Mississippi	96,800	102,000	98,900
Montana	25,100	25,000	24,900
Nebraska	6,150	8,000	6,100
New Mexico	145,575	154,000	145,575
Oklahoma	506,600	530,000	505,850
Texas	2,827,600	2,690,000	2,827,600
Dist. 1 (Southwest)	33,575		33,575
Dist. 4 (Southwest)	259,450		259,450
Dist. 2 (Gulf Coast)	166,475		166,475
Dist. 3 (Gulf Coast)	486,675		486,675
Dist. 5 (Eastern)	57,100		57,100
Dist. 6 (Eastern)	117,950		117,950
East Texas field	277,200		277,200
Dist. 7-C (West)	108,350		108,350
Dist. 8 (West)	992,925		992,925
Dist. 7-B (W. Central)	83,600		83,600
Dist. 9 (N. Central)	159,550		159,550
Dist. 10 (Panhandle)	84,750		84,750
Utah	3,600	5,000	3,800
Wyoming	190,100	178,000	189,200
Total United States	*6,200,500	6,140,000	6,206,350
Change from prev. week, down	5,850		
Canada	174,890		129,330

Total U. S. production January 1-September 15 †1,568,995,400 bbl.
Same period last year (crude plus cond.) 1,353,403,755 bbl.

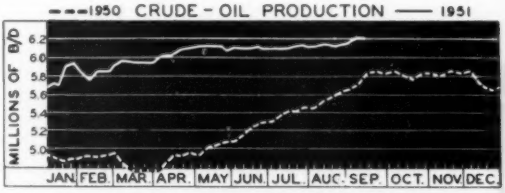
*Not including 102,800 bbl. condensate. †Including 27,109,460 bbl. condensate.

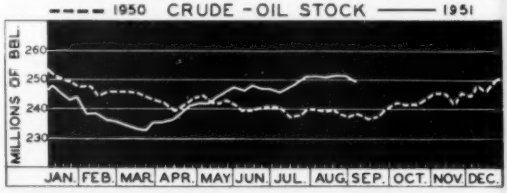
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

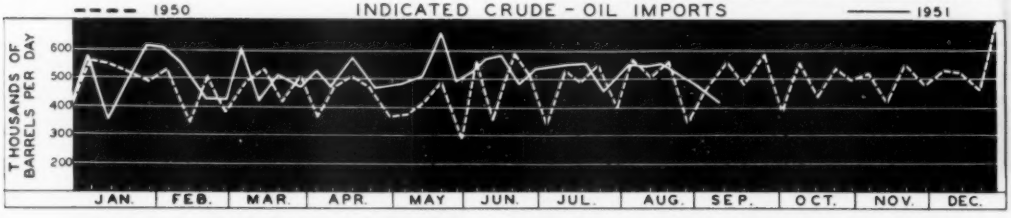
(Thousands of barrels)

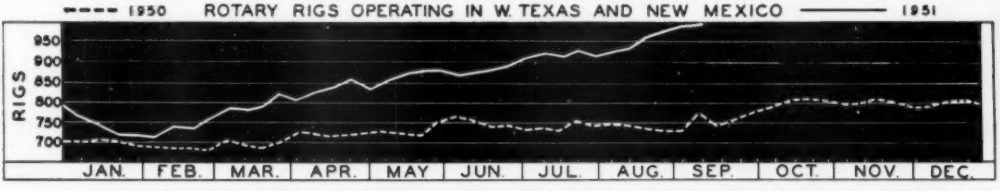
	Sept. 8, 1951	Sept. 1, 1951	Sept. 9, 1950
Pennsylvania Grade	2,142	2,091	2,449
Other Appalachian	1,511	1,666	1,398
Illinois, Indiana, Michigan	10,995	11,380	9,590
Arkansas	2,751	2,514	2,903
Louisiana	14,324	14,645	14,459
North	2,725	2,756	3,153
Gulf	11,599	11,889	11,306
Mississippi	2,848	2,681	2,615
New Mexico	6,602	6,417	6,030
Oklahoma and Kansas	38,730	38,420	33,852
Texas	119,595	120,963	114,767
East Texas	14,708	15,141	14,256
West Texas	50,003	51,010	44,967
Texas Gulf	26,786	26,907	28,171
Other Texas	28,098	27,905	27,373
Rocky Mountain	13,082	13,049	10,776
California	29,789	30,357	31,385
Foreign	7,434	7,975	6,214
Total	249,803	252,158	236,438

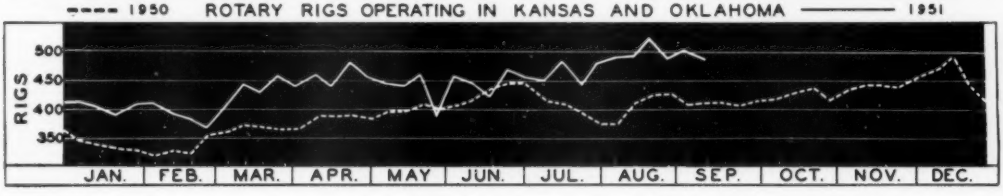
*Bureau of Mines.









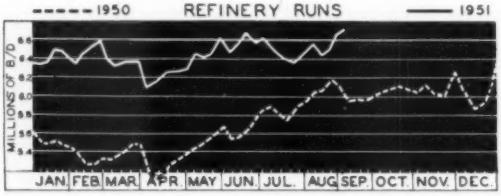


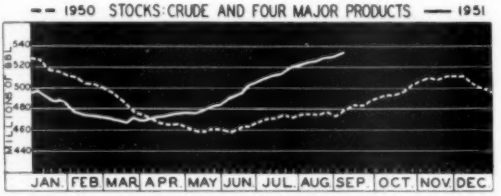
A.P.I. REFINERY REPORT, SEPTEMBER 8

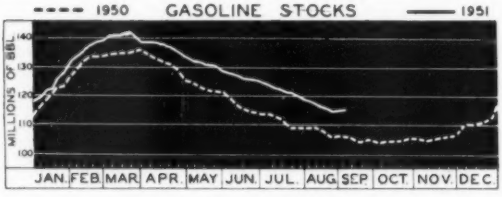
(Thousands of barrels)

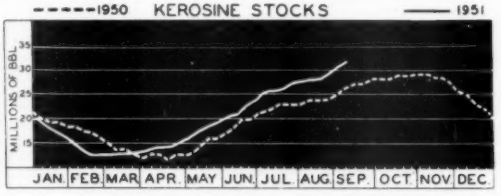
District—	Daily avg. crude runs	Daily average production				Stocks at refineries, bulk terminals, in transit and in pipe lines				Bureau of Mines, September 1950				
		Gasoline*	Kerosine	Distillate	Residual	Gasoline†	Kerosine	Distillate	Residual	Daily avg. crude runs	Daily average production			
											Gasoline*	Kerosine	Distillate	Residual
East Coast	1,036	442.1	45.1	227.4	220.3	25,277	11,567	29,801	12,097	983	386.5	43.9	219.2	219.8
Appalachian:														
District 1	111	50.1	3.7	16.0	10.7	2,918	649	1,041	659	105	46.2	6.3	11.9	10.1
District 2	77	40.4	2.6	10.4	16.1	1,541	335	396	297	73	35.5	4.8	8.4	14.6
Ind., Ill., Ky.	1,237	655.0	80.0	203.9	153.4	25,096	7,128	20,412	5,788	993	512.7	59.7	166.4	141.5
Okla., Kans., Mo.	496	273.9	13.9	120.0	59.3	11,696	1,855	10,549	1,872	510	287.4	17.3	119.1	55.5
Inland Texas	266	168.4	17.7	40.6	41.7	3,834	588	1,666	1,144	212	149.2	10.5	32.1	34.6
Texas Gulf Coast	1,647	713.9	138.9	328.3	269.3	17,554	5,332	10,540	6,575	1,473	664.8	111.3	322.0	259.0
La. Gulf Coast	506	242.3	52.4	127.1	60.9	6,022	2,961	3,984	2,188	496	237.1	56.7	115.2	62.9
N. La. and Ark.	83	35.9	6.6	16.7	7.1	2,534	590	975	176	78	28.2	8.2	17.4	8.8
Rocky Mountain:														
New Mexico	11	5.9		2.3	3.3	126		66	33	13	7.0	.4	2.2	3.2
Other Rocky Mtn.	231	97.4	4.3	45.6	41.7	3,940	418	2,165	1,161	195	87.5	4.9	37.4	34.4
California	1,004	437.0	9.1	109.1	382.0	14,423	559	8,835	16,338	928	406.5	9.0	128.4	333.7
September 8, 1951	6,705	3,162.3	374.3	1,247.4	1,266.4	114,871	31,980	90,430	48,328	6,059	2,848.6	333.0	1,179.7	1,178.1
September 1, 1951	6,666	3,162.9	374.6	1,367.4	1,243.7	115,201	30,417	87,282	47,596					
September 9, 1950	5,971	2,799.3	310.3	1,127.3	1,183.6	106,381	26,640	71,597	42,727					

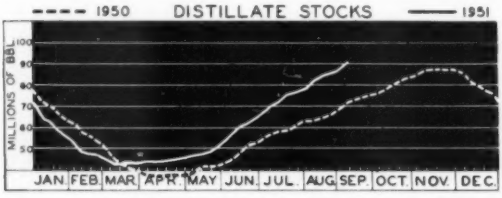
*At refineries including natural blended. †Finished and unfinished.

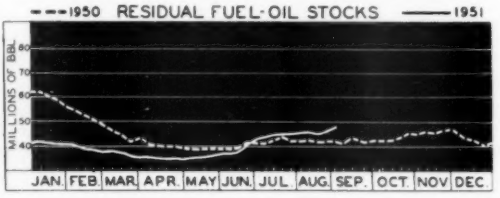


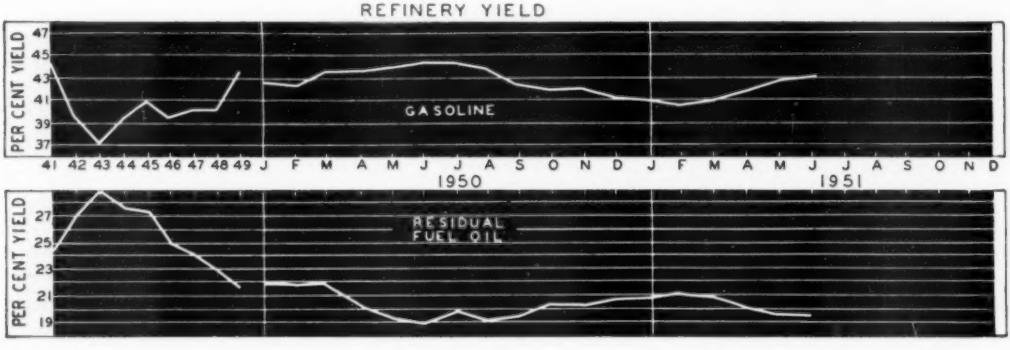











REFINERY YIELD
PER CENT YIELD
GASOLINE
41 42 43 44 45 46 47 48 49 J F M A M J J A S O N D J F M A M J J A S O N D
1950
1951
PER CENT YIELD
RESIDUAL FUEL OIL

CRUDE PRICES GRAVITY SCHEDULE

	Signal Hill, Calif.‡	Oklahoma, Kansas	Gulf Coast Tex.*	West Tex.†
18-18.9	$1.93			
19-19.9	1.98			
20-20.9	2.03	$2.25		$2.12
21-21.9	2.07	2.27		2.14
22-22.9	2.12	2.29		2.16
23-23.9	2.18	2.31		2.18
24-24.9	2.24	2.33	$2.56	2.20
25-25.9	2.30	2.35	2.58	2.22
26-26.9	2.36	2.37	2.60	2.24
27-27.9	2.41	2.39	2.62	2.26
28-28.9	2.46	2.41	2.64	2.28
29-29.9	2.52	2.43	2.66	2.30
30-30.9	2.57	2.45	2.68	2.32
31-31.9	2.62	2.47	2.70	2.34
32-32.9	2.68	2.49	2.72	2.36
33-33.9		2.51	2.74	2.38
34-34.9		2.53	2.76	2.40
35-35.9		2.55	2.78	2.42
36-36.9		2.57	2.80	2.44
37-37.9		2.59	2.82	2.46
38-38.9		2.61	2.84	2.48
39-39.9		2.63	2.86	2.50
40 and above		2.65	2.88	2.52

*For crude from Daboval, El Campo, and Sand Point.

†Includes Lea County, New Mexico. Last general price change represented a 50-cent increase becoming effective December 6 1947.

‡Standard Oil Co. of California

FLAT CRUDE PRICES

Representative posted schedules per barrel	
East Texas†	$2.65
Kettleman Hills, California*	2.90
Beauregard Parish	2.60
Illinois Basin	2.77
Pecos County, Texas (Yates)	2.35
Bradford, Pennsylvania	4.25
Eastern Ill. and Western Ind.†	2.77
Tomball, Texas Gulf Coast	2.83

*37°-37.9°. †35° and above

IN the Group 3 area a marketing paradox exists in that residual fuel is the only major product that can be classified as tending to be soft, and at the same time it is the one product which many suppliers believe may be in short supply in District 2 during the winter months. Any residual offered at prices below the market is likely to be limited in quantity to 5 or 10 cars.

Inquiries on the Group 3 market for No. 3 fuel are reported to have increased in the past few weeks. Some marketers believe that this results from buyers' attempts to feel out the No. 2 market, since some of the prospective buyers were willing to accept material meeting No. 2 specifications except for color.

It is probable that bargain hunters hope to locate a few suppliers who need to move some distillate and yet who hesitate to offer No. 2 at lower prices because of the effect on the general market. Since distillate inventories normally increase until about the end of October, some suppliers may have to move at No. 3 prices some material which could be marketed as No. 2 in times of short supply. Very little distillate is manufactured to sell as No. 3 in the Mid-Continent.

The second increase for natural gasoline since the first of September raised Grade 26-70 on the Group 3 market to 6.375 cents a gallon or .125 cent higher than at this time last year but .5 cent under last year's peak, reached in December.

Gasoline-price wars at the service-station level continue at widely scattered points over the country but with a large part of the total volume concentrated in the area on the East Coast between Philadelphia and New York City. Production and stock trends indicate that the gasoline supply this winter will be long compared with a normal year.

REPRESENTATIVE QUOTATIONS

Representative spot-market quotations of leading suppliers as of September 17, 1951. Figures are f.o.b. plant for tank-car shipments in cents per gallon, except for residual fuel oil which shows the price per barrel and wax, in cents per pound.

GASOLINE, KEROSINE, AND FUEL OILS

	Mid-Continent Group 3	New York Harbor (barge)	Texas Gulf Coast
Regular gasoline, 80-82 octane	10¼-10½	12-12.75	10¾-11
Premium gasoline, 86-88 octane	11¼-11½	13.5-13.75	11¾-12
42-44 w.w. kerosine	9-9⅜	10	9
No. 2 straw fuel oil	8-8⅝	9	8
No. 6 residual	$1.70-1.80	$2.45-2.60	$1.75-1.90

NATURAL GASOLINE

	Group 3	North Texas	N. La
Grade 26-70	6⅜	5⅞	6⅛
Grade 18-55	7.65	7.15	7.40

LUBRICATING OILS

South Texas

200 vis., No. 2-3 neutral	13-13.5
750 vis., No. 3-4 neutral	16
2,000 No. 5-6 neutral	18-19

LUBRICATING OILS

Mid-Continent

150-160 vis., D bright stock, 0-10 pp.	29-30
200 vis., No. 3 neutral, 0-10 pp.	17.5-18.5

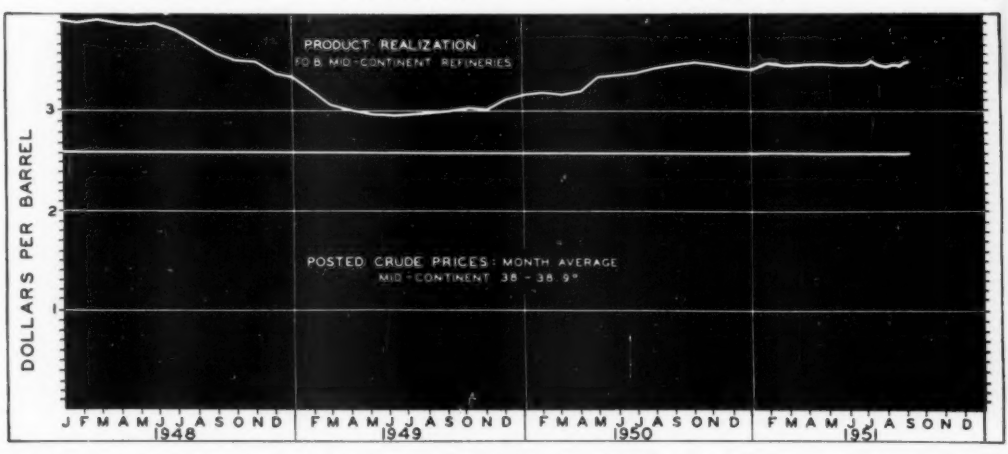
Western Pennsylvania

145-155 vis., 10 p.t. bright stock	32.5
180 vis., 0 p.t. neutral	31.5

WAX

Mid-Continent

132-134 A.M.P.	6.0


PRODUCT REALIZATION
F.O.B. MID-CONTINENT REFINERIES
POSTED CRUDE PRICES: MONTH AVERAGE
MID-CONTINENT 38 - 38.9°
DOLLARS PER BARREL
3
2
1
J F M A M J J A S O N D
1948
F M A M J J A S O N D
1949
F M A M J J A S O N D
1950
F M A M J J A S O N D
1951

In this trend chart refinery realization is based on average Mid-Continent grade crude oil (not 38° gravity only) and average prices for refinery products as published in The Oil and Gas Journal basis Oklahoma (Group 3). Refinery yields confined to gasoline, kerosine, distillate, and fuel oil. Realization averaged $3.53 for week ended September 8, $3.51 for previous week, and $3.51 for September 1950.

EQUIPMENT MEN . . . in the News

Refinery Supply to Open Houston Branch

W. A. Schlueter has announced that Refinery Supply Co. will open a Houston branch. The Houston facilities, including a large warehouse, will carry a complete line of Refinery Supply Co. and Cenco specialties. An engineering staff will also be maintained in Houston to give customers in that area the best possible service.

Spalding Is Appointed To Otis Canadian Office

Jim G. Spalding has joined Otis Pressure Control Export Corp. as sales and service engineer for Canada. He will be stationed at the newly established Otis office in Calgary.

Spalding formerly was with Mene Grande in Venezuela. After returning to the United States he spent several months working out of Otis division offices in New Iberia, La., and Odessa, Tex.

Baash-Ross Holds Grand Opening of New Plant

One of the most modern and complete machine shops in the Southwest was officially placed in operation at Odessa, Tex., at the grand opening of Baash-Ross Tool Co.'s plant and warehouse.

Featuring a large number of machine tools, the plant's outstanding attraction was a pressure welding machine designed for stubbing or joining parts of drill collars or heavy shafting. This machine will weld collars up to 8 in. in diameter.

The welding process consists of machining a partial chamfer on both the inside and outside edges of the drill-collar wall, and machining a precisely flat surface on the remainder of the joint face, perpendicular to the axis of the collar. Parts of the collar to be joined are then placed in the machine, pressed together under as much as 40,000 psi. pressure, and heated with a ring-type acetylene flame to a plastic-like state but still below the melting point of the steel. The combination of heat and pressure forces the parts of the collar together leaving an upset section on the inside and outside of the collar which are machined off and the joint is heat treated to finish the process.

Other equipment in the new plant includes large lathes, hoists, other machine tools, furnaces, and welding equipment. Warehouse space is also provided for equipment which the company markets.

Continental Supply Names Personnel Changes

George P. Daley, field salesman at Harvey, La., for Continental Supply Co., has been appointed store manager at the same location.

Jack R. Barron, assistant store manager at Kilgore, Tex., has been appointed store manager at Palestine, Tex.

Baroid Establishes New Texas Field Offices

The tremendous expansion of oil activity in the West Texas area has prompted Baroid sales division of National Lead Co. to establish new service headquarters and field offices in Midland, Tex.

Heading drilling-mud sales and service from the new offices will be J. J. Edwards, assistant manager of Baroid's Mid-Continent division of West Texas, New Mexico, North Central Texas, and the Panhandle. Working with Edwards will be D. D. Varnell, Mid-Continent division assistant sales manager, and S. E. (Tox) Wiginton, district superintendent for West Texas and New Mexico.

S. E. Geffen, Baroid district superintendent for North Texas and the Permian basin, will be in charge of the Baroid well-logging service in the area.

McCormick Appointed Caterpillar Distributor

W. F. McCORMICK

Announcement was made recently of the appointment of McCormick Machinery Co., Tulsa, as Caterpillar distributor for the 38 eastern counties of the State of Oklahoma. Formerly operating as a branch of Southwest Machinery Co., with headquarters in Oklahoma City, McCormick Machinery has become an independent corporation, retaining most of the lines of heavy construction machinery that it has always handled, including Caterpillar, Athey, Hyster, Trackson, Bucyrus-Erie, Joy, Cedar Rapids, Martin, Carver, and Kohler.

A branch office with complete parts and service facilities is being built at Ada, Okla., to serve the southeastern part of the state. This new building will be completed the latter part of September and will contain 10,000 sq. ft. of floor space.

W. F. (Mac) McCormick, president and general manager of McCormick Machinery, began his career with Caterpillar in 1921. He moved to Tulsa in 1929 and has served through eight Caterpillar distributorships in the ensuing years, culminating in the formation of McCormick Machinery Co., July 2, 1951.

Executives of the company, in addition to McCormick, are John W. Neilson, vice president and sales manager; H. W. Mosley, secretary-treasurer and office manager; David A. Miller, advertising manager and assistant sales manager; Norman W. Case, general service manager; Charles C. Arnette, general parts manager, and Charles E. Tucker, branch manager at Ada.

(Continued on page 390)

New headquarters of McCormick Machinery Co., which covers eight acres in Tulsa's east-side industrial section.

Your MARKET PLACE FOR THE OIL AND GAS INDUSTRY...

CLASSIFIED ADVERTISING

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$12.00 a column inch one issue . . .
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EQUIPMENT FOR SALE

USED ROTARY AND CABLE TOOL DRILLING TOOLS, WIRE LINES, E. A. KELLY, BOX 861, OKLAHOMA CITY. PHONE 5-6407.

502 FEET 10-inch seamless casing, like new, 40 pound, 8 V threads. Near Tulsa. 1208 E. 20th St., Tulsa. Phone 3-9232.

FOR SALE: 2 Sullivan 37 Special rigs mounted on International trucks, Waukesha and Buda drill motors. 1700 ft. Sullivan 2⅜ tool joint drill pipe 20 ft. one 800 gallon water tank mounted on late model Chevrolet truck. Two four wheel rod trailers, two 260 gallon gasoline trailers. Equipment in top shape, used less than two years. Nothing additional needed to start drilling. Will sell any part separately except drill pipe. TRANS-TEX EXPLORATION CO., Box 558, Abilene, Texas. Phones 2-7565—4-8130.

FOR SALE: 3—40 hp. 2 cycle Superior gas engines and 3—OCS countershaft reversible clutches complete with V belts. All in first-class condition. Solar Oil Corporation, 1117 Union National Bank Bldg., Wichita, Kansas.

FOR SALE—SHOPPED AND TESTED

15000'—5½" OD 14# Seamless R-2 8R—once run casing.
8000'—7" OD 17# Seamless R-2 8R Casing—once run.
5000'—7" OD 20# Seamless R-2 10V Casing.
5000'—7" OD 24# Seamless R-2 10V Casing.
10000'—2⅞" EUE 8R R-2 Seamless Tubing—once run.
10000'—2⅞" EUE R-2 10V Seamless Tubing.

We also carry a large line of Lapweld Casing and Tubing. Please call us.

SABINE MACHINE & SUPPLY CO.
Phones 3094-3095-3436 Kilgore, Texas

FOR SALE

10,000 FEET 4" O.D. x .054" WALL SEAMLESS ALUMINUM TUBING

Spec. Alcoa 63 St 6—40 ft. Lengths

Working Pressure to 250 P.S.I.

Excellent for irrigation line, water service, etc.

Complete with galvanized 4 bolt Dresser Heavy duty couplings

ALL USED ONLY FEW MONTHS—CONDITION PERFECT

Prompt Shipment subject to prior sale. Price including couplings—51c foot

F.O.B. White Haven, Pa.

L. B. FOSTER COMPANY
New York City—Pittsburgh—Chicago Houston

EQUIPMENT FOR SALE

FOR CABLE TOOLS
DEGEN PIPE AND SUPPLY CO.
Box 107, Red Fork Station, Tulsa, Oklahoma

FOR SALE: Seamless casing and tubing new and second hand. Phone Rogers Pipe and Supply Co., Tulsa, Okla.

FOR SALE: U-15 rotary rig in first-class condition. Has 3 NKU Waukesha motors with less than 1 year service. Without mast or drill pipe. $80,000.00. Will consider good 4000 ft. rotary as part payment. Box E-286, The Oil and Gas Journal, Tulsa, Okla.

NEW PIPE

85,000 Feet 8⅝" OD, ¼" Wall, 30 foot lengths, beveled ends for welding, electric welded, weight 23#, made to API-5L specs. Delivery First quarter 1952, CMP rating required, or DO, or PAD.

GREAT PIPE & STEEL CORP.
1159 S. Broadway, Los Angeles, 15, Calif.

EQUIPMENT FOR SALE

FOR SALE: Gas distributing system including main, gathering and distributing line, meter regulators; also franchise covering about 30 miles of territory paying approximately $2,400 a year, now can be built to $10,000 with about 4 miles more line. Reason for selling, age and health. 119 Olive Street, Leavenworth, Kansas Phone 692-W.

FOR SALE

OIL WELL CASING AND TUBING

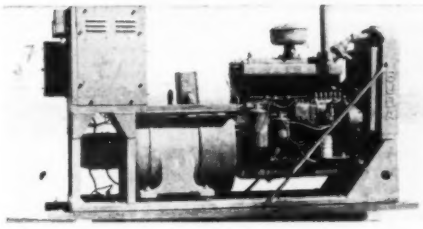
Approx. 3000' New H40 7" O.D., 20# Seamless 8 R.T., R.2

Approx. 3000' New J-55 8⅝" O.D., 24# Seamless 8 R.T., R.1

Approx. 3000' ±1 Used Grade C 5½" O.D., 14# Seamless 10 V.T., R.1 & 2.

MICHIGAN CARLON PIPE COMPANY
20050 Livernois Ave., Detroit 21, Mich.
Diamond 1-1400

FOR SALE



BUDA, Diesel model 6 DTG 317, with 30 KW 37½ KVA 127 220 volt A.C. 3 phase, 60 cycle Century Generator, Army Surplus, unused	$2,850.00
LEROI, model 20 A-D 382 W, with 25 KW 110 220 volt A.C. 3 phase, 60 cycle, Westinghouse Generator, unused	2,250.00
Same Engine and Generator 25 KVA single phase, unused	2,250.00
HERCULES, JXD power plant 16 KW 110 volt D.C., mounted on 4 wheel trailer, unused	1,350.00
KOHLER, 10 KW 110 220 A.C. fully automatic rebuilt	750.00
KOHLER, 8 KW 110 220 A.C. rebuilt	650.00
UNIVERSAL, 5 KW D.C. rebuilt	375.00
KOHLER, 1½ and 2 KW D.C. rebuilt	295.00
KOHLER, 1½ KW A.C. rebuilt	295.00
CATERPILLAR, Diesel D4400, 15 KW A.C. 3 phase Light Plant, skid mounted, like new	2,250.00
WAK WAUKESHA Engine 4 cylinder, natural gas carburetor—starting engine—"Twin Disc" clutch and radiator, excellent condition	1,250.00
WAK WAUKESHA Engine 6 cylinder, natural gas carburetor—electric starter—"Twin Disc" clutch and radiator, excellent condition	2,500.00

GORDON AND POPE SUPPLY COMPANY
LOckwood 2093 2468 EAST LANCASTER
FORT WORTH, TEXAS

EQUIPMENT FOR SALE

PIPE
ALL SIZES: LINE PIPE AND CASING TANKS, AND OILFIELD SUPPLIES. EDCO PIPE & SUPPLY CO., PHONES 933 OR 1298, DRUMRIGHT, OKLA.

FOR SALE: Fred E. Cooper-Allis-Chalmers Model W Double Drum Skid Well Servicing Machine. First-class condition, equipped with Drum Dividers, Starting Equipment and Mast Frames but no Mast. Write or call Buckeye Supply Company, Zanesville, Ohio.

ONE MUSKOGEE heavy duty single drum, rod, tubing and bailing unit. Skid mounted. A-1 condition. Harry Mach. Phone 62-6143 or 9-4746, Oklahoma City, Oklahoma.

NEW CASING AND TUBING

Will furnish at regular prices for reasonable working interest in proven producing property. Advise complete particulars with map attached. Box E-340, The Oil and Gas Journal, Tulsa, Oklahoma.

EQUIPMENT FOR SALE

FOR SALE: 15,000′ 4½″ drill pipe suitable for line or casing. P. O. Box 4154, Tulsa, Oklahoma.

TUBING & CASING for Sale, all sizes and quantities, New and Used. Box E-338, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE

10 x 15 Connersville Meter #12762—55000 cu. ft. per hour rating—125 psig. W. P. Equipped with Foxboro PVTT Gauge. Factory reconditioned. Proof curve available. Located our Bluffton, Indiana, Warehouse.

Phone or Write

L. A. MUSSMAN

PANHANDLE EASTERN PIPE LINE COMPANY

1221 Baltimore
Kansas City 6, Missouri
Phone Baltimore 3700

EQUIPMENT FOR SALE

FOR SALE: 1—"Caterpillar" D-17000 Diesel Electric set, 440 V, 3-phase, 60 Cycle, AC radiator W/blower fan, safety device, muffler, and Firestone vibration dampeners. 2—Fuel Tanks and connections. 1—Steel Building for Caterpillar. Terms Cash; Can be seen at our McMackin Lease, 3 Miles West of Salem, Illinois. No Junk. Absher & Booth, 721 Thompson Building, Tulsa 3, Oklahoma.

FOR SALE: Ideal slush pump, Model C-150. Melton Supply Company, Seminole, Oklahoma.

3—290 Brl. National steel welded stock tanks, with walkway and stairs. Write Box 1581, Tulsa, Oklahoma, or Phone 5-3545.

Gaso Duplex 4½″ x 6″ Power Pumps with Chrysler C-36 Engines. Skid mounted, immediate delivery. Also Byron Jackson, Carter Centrifugal Units. Westinghouse 20-25-50 KW Generating Units.

H. H. COFFIELD
Attn.: W. H. ORR
Phones: 132—Rockdale, Texas
AT-3427—Houston, Texas

FOR SALE

22-W Bucyrus-Erie Spudder mounted on 6x6 army truck, complete with tools.
10,000 feet 2⅜″ O.D. 4.60# Range 1 and 2 10 Round Thread #1 seamless tubing.
4,000 feet 2⅜″ O.D. 4.70# Range 1 11½ V Thread #1 external upset seamless tubing.
5,000 feet 5½″ O.D. 15.50# Range 2 8 Round Thread once run seamless casing.
1,000 feet 10¾″ O.D. 32.75# Range 1 and 2 8 Round Thread once run seamless casing.
10,000 feet 2⅜″ O.D. 4.70# Range 1 11½ V Thread #1 lap weld external upset tubing.
10,000 feet 2⅜″ O.D. 4.60# Range 1 11½ V Thread #1 lap weld regular tubing.
5,000 feet 5½″ O.D. 17# Range 1 11½ V Thread #1 lap weld casing.
50,000 feet ⅞″ x 25′ Type 2 and 3 Jones sucker rods with 15/16″ API box and pin, #1 used, like new.

THE SANDY SUPPLY COMPANY
Phone 2-8766 Zanesville, Ohio

NEW SEAMLESS TUBING

4″ OD—12 gauge wall. Asphalt coated, 40 foot lengths, 14,500 feet available.

NEW ELECTRIC WELD

26″ OD—281 wall. Untested. 40 foot lengths, 2,000 feet available.
1½″ and 2″ OD

RECONDITIONED

Approximately 11 gauge wall, 200,000 feet available.

Complete stock of structural steel and plates available. Submit Inquiries.

Write—Wire—Phone

X-757

CASING—TUBING—LINE-PIPE

15,000′ of 4½″ OD, R-2, used SS drill pipe casing, new 8 rd. thrds., and new J-55 regular casing couplings, hydrostatically tested 2500#.
2,000′ of 5½″ OD, 14#, 10V thrd., R-2, used SS casing.
5,000′ of 2⅜″ OD, 4.60#, 11½ V thrd., 25′ lengths, regular used SS tubing.
5,000′ of 2⅜″ OD, 4.70#, 10 V thrd., EUE, R-2, used SS tubing.
4,100′ of 2⅞″ OD, 6.50#, 8 rd. thrd., EUE, R-2, used SS tubing.
100,000′ of 4½″ OD, 0.188″ wall, DRL, 1800# test, PE, new electric weld line pipe.
5,000′ of 2⅞″ OD, PE or T&C, R-1, used SS tubing.

BROWN PIPE & MACHINERY COMPANY
P. O. Box 2368, Phone 3-9391, Corpus Christi, Texas

TOWERS and EXCHANGERS

1—7′6″ ID x 72′ OVERALL x 1.68″ THICK TOWER

470# w.p. 4′5″ of shell and all nozzles and manways Hastelloy lined, wt. approx 190,000#.

2—7′ ID x 117′6″ OVERALL TOWERS

Shell 11/16″ and 13/16″, top head 11/16″, bottom head 13/16″, 50 CI bubble trays w/49 and 43 caps per tray on 24″ and 30″ spacing, wt. 206,580#.

1—CONDENSER, 2035 SQ. FT. SURFACE

Single pass shell, 6 pass tubes, 648—¾″ O.D. Seamless steel tubes, 13 BWG, 16′ long, 1″ sq. pitch, shell 34″ OD x ⅝″ thick, wt. 18,268#.

Please wire, phone, or write for additional information

NEWMAN'S, INC.

700 S. Maybelle, Tulsa, Okla.
Phone 2-5228—LD-635

FOR SALE

PIPE—TANKS—EARTH MOVING EQUIPMENT

Approx. 7 miles 3″ & 4″ T.&C. line pipe.

14—Joints 5⅞″ Drill Pipe and Tool Joints.
3— 65 bbl. 1 Ring Cone Deck Bolted Tanks.
1— 500 bbl. 2 Ring Cone Deck Bolted Tank.
1—1,500 bbl. 3 Ring Cone Deck Bolted Tank, Insulated.
2—2,000 bbl. 2 Ring Cone Deck Bolted Tanks with Heating Coils and Boiler.
2—3,000 bbl. 3 Ring Cone Deck Bolted Tanks.
1—Caterpillar D-8 Cat & Dozer.
1—Caterpillar #28 Ripper.
1—Allis-Chalmers Model A.D. 4 Grader.

Above Material and Equipment is now located near Craig, Colorado

R. H. TECKLENBORG CO.
Harbor Hotel, Steamboat Springs, Colorado

EQUIPMENT FOR SALE

FOR SALE: One super model Wilson single drum servicing unit, 80 hp. Waukesha, 4,000′ wire, all tubing tools, mounted on GM 4-wheel drive truck. $3500. Phone Rogers Pipe and Supply Co., Tulsa, Okla.

THE FOLLOWING used equipment located in South Texas: 2—80 HP Fairbanks-Morse Model 47A13 Gas-Diesel engines now equipped for Diesel operation, single cylinder horizontal 14″ x 18″ each with two flywheels, 175-385 RPM, serial numbers 788306 and 787864 with 4″ size number 4 fast flexible couplings. 2—Radiators with fans that have been used for cooling 60 HP continental engines described as follows: Star Radicooler serial #6601, Star Manufacturing Company, Oklahoma City, style 60-70 air cap. 7,000 CFM, water cap. 30 GPM, consists of: 30″ x 39″ tubular radiator, 1-28″ diameter 6 blade fan, 1-2″ single style center pump, 1-4 groove sheave on fan shaft 5⅜″ OD "B" section, unit mounted on channel iron base 33″ x 52″, 6″ x 1⅞″ x 7/32″. Buda Engine Sales & Service, Inc., Box 1159, Tulsa, Oklahoma.

FOR SALE: 2—18′ x 36′ Braden Sectional Steel Corrugated Iron Buildings erected in Seminole Field. $450 each. Cities Service Oil Company, Patridge, Bartlesville, Oklahoma.

FOR SALE: 10,000 ft. Long range, once run, 14# seamless 5½″ casing, 10V thread. $2.75 p ft. and will cold water test. Box 428, Kilgore, Texas.

FOR SALE: 30,000′ of 4½″ API Full Hole and Extra Hole Drill Pipe. Joints measure 5¾″ to 6″ OD. PHIL. A. CORNELL & CO., Oklahoma City, Oklahoma.

CASING PULLING CONTRACTORS with Hydraulic Equipment: Experienced operators—Pull any size pipe, anywhere. Also will buy wells for salvage. GENERAL CASING PULLING CO., P.O. Box 4387, Oklahoma City. Phone 6-1335.

FOR SALE: Cardwell L draw works with air operated Twin Disc clutches, transmission, GAK Waukesha. Good condition. CLAYPOOL DRILLING COMPANY, St. Elmo, Illinois.

SPUDDERS, BUCYRUS, Wichita, Fort Worth, also rotaries and core drills. Good used equipment, tools, pipe, cable. Everything for well drilling. Fishing tools rented. Pressey & Son, Pueblo, Colorado.

FOR SALE

Model M Wichita Spudder (2000 ft.), with Waukesha motor and complete tools, lines, winch, truck and Caterpillar tractor.

P.O. BOX 1098, or PHONE 1432 Shawnee, Okla.

FOR SALE DEPROPANIZER

TAKEN OUT OF SERVICE AND REPLACED WITH LARGER VESSEL AUGUST 1951

SPECIFICATIONS

FABRICATOR: WYATT

DESIGN:
API-ASME CODE, 369 psi. W.P., 400° F., 554 psi. Test, 462 psi. Hammer Test Pressure.

DIMENSIONS:
30″ x 48′ 0″ plus 1′ 0″ Skirt, .500″ Shell, .500″ F & D Heads, ESTIMATED WEIGHT 12,354#

TRAYS:
30 on 16″ Spacing, Bubble Type, 13—4 x 4 x 3 Caps per tray, 2″ OD risers, side type downcomer

LOCATION:
Plant site near Bishop, Texas

CONDITION:
Excellent

PRICE: $4,500.00 where is, as is, subject to prior sale.

SOUTHERN MINERALS CORP.

P. O. Box 716 Corpus Christi, Texas

EQUIPMENT FOR SALE

FOR SALE: One Bucyrus-Erie 36 L Spudder three and one-half years old. Complete top to bottom tools 15½ to 5½. Also complete tailing in tools. All in first-class condition. List on request. J. E. Griggs, 310 East Third St., Mt. Carmel, Illinois. Phone 959.

PIPE LINERS—3800 6″ Short Dresser Couplings w/ Bolts Less Rubbers and 5000—4″ Victaulic Couplings w/ Bolts Less Rubbers All For Sale by Printy Pipe & Supply, Cut Bank, Montana.

HALL SCOTT Defenders 650 hp. left or right hand rotation, 2:1 or direct drive. Good condition, $2500. L. E. Northrop, Jr., 686 E. Las Flores Dr., Altadena, Calif.

FORT WORTH Model-D Spudder, tools for large diameter hol's, 2289′ 10¾″ 40.50# P.E. and 925′ 12¾″ 49.56# P.E. all seamless new line pipe. Cash, no trade. Contact Aycock, or Andrews, El Fidel Courts, Espanola, N. M.

WANT EQUIPMENT: Did you find the equipment you wish to purchase in this column? If not, use an "Equipment Wanted" classified advertisement to find it. It is available somewhere and Journal classified advertisements will find it. See box heading for classified rates, or write The Oil and Gas Journal.

EQUIPMENT WANTED

WE BUY drilling equipment, machines, cable tools, pipe, etc. Turn your surplus equipment into cash. Pressey & Son, Pueblo, Colorado.

EQUIPMENT WANTED

WISH TO BUY: Oil field equipment, gasoline engines, pumping units, etc. Tulsa Supply Co., P.O. Box 294, Tulsa, Oklahoma

125 HP to 300 HP, 300-lb. working pressure boilers wanted. Near Midland, Texas Tex Harvey Gasoline Plant, 714 Atlas Life Bldg. Phone 54-5201, Tulsa, Oklahoma.

WANTED—10¾″ or 9⅝″ Regan blowout preventer. State price and location. Folk Drilling Co. Phone 443, 614 Main, Yukon, Okla.

WANTED—Failing model 500 or 1000, or Franks model F rotary drill, also 5 X 8 or 5 X 10 mud pump. Fred E. Bulter, Box 1832, Casper, Wyo.

WANTED FOR CASH

Electric Motors—Starters, Transformers —Oil & Air Brkrs. Wire—Cable—Wiring Materials.
Send Listings

ALLIED ELECTRIC & MACHINERY CO.
1007 Falls Bldg., P. O. Box 1838
MEMPHIS 1, TENN.

WANTED TO BUY:
NEW — SURPLUS — USED
OIL STORAGE TANKS

Capacity 20,000 gallons and other sizes. Mounted or Dismounted.

Box E-336, The Oil and Gas Journal, Tulsa, Oklahoma.

HELP WANTED

HELP WANTED

OVERSEAS POSITIONS

An American oil company in South America has positions open for qualified technical personnel.

Refinery Chemist—Must have a college degree and a minimum of four years' experience in oil refinery control laboratory. Experience in manufacture of lube oils and greases desirable. Single man preferred.

Mechanical Engineers—Engineering degree and minimum of five years' experience in mechanical drafting and design of oil refinery or chemical plant process piping and equipment.

Electrical Engineers—Must have E. E. degree and five years' experience in design, operation, and maintenance of electrical installations in oil refineries or chemical plants including generators, motors, motor control, and switch gear.

Mechanical Foreman—Must have eight to ten years' experience in maintenance and repair of all types of pumps, compressors, and motors pertaining to oil refinery operations. Will be required to supervise and coordinate the activities of mechanics in installation, maintenance, and repair of this equipment.

Maintenance Engineers—Mechanical or Electrical Engineers with a minimum of five years' experience in a modern oil refinery to work in coordination and supervision of maintenance and construction.

Corrosion Engineers—Degree and minimum of five years' experience in corrosion engineering. Will be required to make studies and investigations of causes and nature of corrosion pertaining to equipment utilized in oil producing operations.

Pipeline Engineers—Degree and four to ten years' experience in design and construction of pipelines, gathering systems, pump stations, tank farms and terminals.

Drilling Engineers—Degree and minimum of three years' experience required. Will be required to maintain and analyze records on drilling equipment performance and make recommendations to improve the efficiency of drilling operations.

Equipment Inspectors—Graduate Engineers with minimum of four years' experience in refinery inspection required.

Pipeline Foreman—Will be required to supervise maintenance and construction of trunk pipeline system.

Write giving age, education, marital status, and details of previous experience. Your communications will be held in strict confidence.

BOX 308-S—RADIO CITY STATION
New York 19, New York

HELP WANTED

PRODUCTION Superintendent or Production Engineer to manage producing leases and drilling wells for small company. Experience with water flood desirable. Give experience and age in letter, and also salary required. All letters confidential. Address Box E-335, The Oil and Gas Journal, Tulsa, Oklahoma.

WANT college graduate chemist to manage asphalt laboratory for West Coast manufacturer of petroleum products. Box E-362, The Oil and Gas Journal, Tulsa, Oklahoma.

WEST COAST Independent refinery wants superintendent. Desire a man with college technical education and one who has had experience in asphalt. Top job for right man. Box E-363, The Oil and Gas Journal, Tulsa, Oklahoma.

MAJOR OIL COMPANY requires graduate engineer, prefer operating and maintenance experience in gasoline plant, cycling plant, pressure maintenance plant, or refinery. Incumbent will assist plant superintendent in all phases of plant operation with specialized duties in connection with plant maintenance. Please reply to P. O. Box 2819, Dallas, Texas.

A CHEMIST—Major Oil Company Refinery in Oklahoma. State qualifications and salary expected. Write Personnel Department, Box 381, Tulsa, Oklahoma.

WANTED
SAFETY ENGINEER

A large American oil company in South America requires a thoroughly experienced safety supervisor. Must be a graduate engineer and have five years' experience in supervision of drilling and production safety programs. Will be required to organize and conduct safety conferences, make safety inspections of operations, and make appropriate reports to management.

Write giving age, education, marital status, and complete details of past experience.

Box 308-W
Radio City Station
New York 19, New York

HELP WANTED

WAREHOUSEMAN—Oilfield, for small wildcat operation in Arabia. Must be capable assuming full responsibility ordering stock control disbursing. One year contract. Top wages. Living furnished. No family accommodations. Reply stating age, education, experience. Box E-343, The Oil and Gas Journal, Tulsa, Oklahoma.

DRILLING CO. DESIRES experienced man familiar with oil field equipment. Duties, checking prices and keeping material records. Supply store experience preferred. Position in Tulsa Office. Reply giving past employment record and salary expected. Box 342, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: Petroleum chemist or treating engineer with two to four years' experience in gasoline treating for technical service with large chemical company selling to the petroleum industry. Position involves considerable traveling in East and Middle-West. Please include details of education and professional experience, as well as a recent photograph, in first letter. Box E-358, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: Assistant plant manager for petroleum wax compounding plant. Experience in petroleum refining desirable together with necessary plant experience in gauging tanks, pipe work, pumping petroleum products, etc. Plant located New Jersey within 25 miles of New York City. Box E-345, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED IMMEDIATELY: Drilling Contractor for Central Pennsylvania to drill one 8,500-foot Oriskany well and ten shallow 2,000-foot wells. Future very great in these new gas fields. Will back and equip ambitious, competent driller who is a pusher. Contact immediately Winner & Murphy, 218 E. Water St., Lock Haven, Pa.

EXPLORATION ECONOMIST: Excellent opportunity for qualified applicant. Position requires five to ten years experience in oil industry statistics and economics. Prefer college graduate with concentration in economics and accounting. Must have practical knowledge of exploration problems and be familiar with general activities in the industry. Age thirty to forty. Salary open. All replies held confidential. Box E-341, The Oil and Gas Journal.

HELP WANTED

REPRESENTATIVE WANTED—New and used Tube case, and line pipe. Liberal commission. Contact Luside Metal Co., Inc., 808 Granite Bldg., Rochester 4, N. Y.

PRODUCTION SUPERINTENDENT: Progressive independent company looking for man who knows production—look after producing and drilling wells—be able to handle men—a good job for the right man. Write, giving age, experience and salary expected. All inquiries strictly confidential. Address Box E-334, The Oil and Gas Journal, Tulsa, Oklahoma.

FOREIGN and Domestic Oil Employment Directory covering the oil industry, showing where to apply for jobs. Price $5.00. Oil Industry Mailing List, Box 3603, Tulsa, Okla.

GEOLOGIST for aggressive well established producing company. Must have at least six years experience in the Gulf Coast Area and be capable of supervising land deals. If interested, submit details of experience, military status, and salary expected. All replies will be kept confidential. Box E-318, The Oil and Gas Journal, Tulsa, Oklahoma.

FOREIGN gravity-magnetic supervisor. Must be of standing in field. Top salary, subsistence, family living allowance and travel expense. Best working conditions. Our personnel has been notified. Apply Box E-262, The Oil and Gas Journal, Tulsa, Oklahoma.

MAGNETOMETER operator, foreign work. Top salary, subsistence, family living allowance, traveling expenses. Excellent conditions and climates. Our personnel has been notified. Apply Box E-263, The Oil and Gas Journal, Tulsa, Oklahoma.

KEY Seismograph Personnel Needed by Established and Expanding Seismograph Company. Box E-264, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: Petroleum or Mechanical Engineers for oil tool design. Field experience desirable. State age, education, experience and salary expected. Box E-319, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED

Research and Development Engineer capable of taking charge of department with Oil Field Equipment Manufacturer. Reply giving complete resume stating age, education, experience, positions held, and salary expected. All replies confidential. Box E-348, The Oil and Gas Journal, Tulsa, Oklahoma.

OUTSTANDING OPPORTUNITY
FOR ENGINEERS

In the Mechanical, Electrical, Chemical and Petroleum fields with large Oil Well Service Company. Exceptional opportunity for advancement. Give full details.

BOX E-352, THE OIL AND GAS JOURNAL
Tulsa, Oklahoma

LOGGING OPERATORS

With one or more years' experience in Gamma-Ray, Neutron or other Electric Logging. Excellent opportunity with fast growing service company.

State age, education, experience and references.

BOX E-353, THE OIL AND GAS JOURNAL
Tulsa, Oklahoma

WANTED
Aggressive Purchasing Agent

For well established oil well supply company. General office in Oklahoma. Must be experienced in Oil Field Supplies, Drilling and Production equipment. State experience, age and qualifications—all replies held strictly confidential.

BOX E-307, THE OIL AND GAS JOURNAL
Tulsa, Oklahoma

WANTED
REFINERY
SECTION FOREMAN

An American oil company in South America requires a refinery section foreman. Must have qualified experience in full charge of refinery unit operation. Will be responsible for operation of two Foster Wheeler combined distillation units; one crude distillation shell still; and one aviation and specialty unit.

Write giving age, education, marital status, and detailed experience resume. Your reply will be held in strict confidence.

Box 308-C

Radio City Station
New York 19, New York

WANTED
ELECTRICAL SUPERVISOR

An American oil company in South America requires a graduate Electrical Engineer with a minimum of two years' field experience in electrical maintenance and construction. Will be required to coordinate and supervise operative tests and maintenance of FM and AM communication sets, telephone equipment and circuits, and power distribution circuits.

This is a staff position offering retirement plan and other employee benefits. Write giving age, education, marital status, and details of previous experience. Your reply will be held in strict confidence.

Box 308-B
Radio City Station
New York 19, New York

HELP WANTED

ENGINEERS, Executives, Technical Men. Salaried positions—$3600 to $30,000. This confidential service for outstanding men who desire a change of connection. Will develop and conduct preliminary negotiations without risk to present position. Send name and address for details. Tomsett Associates, 334 Frick Bldg., Pittsburgh 19, Pa.

GEOLOGIST: Young man preferably experienced southern Oklahoma geology or scouting. Good opportunity independent company. Write fully stating salary. Box E-351, The Oil and Gas Journal, Tulsa, Okla.

PETROLEUM Engineer. Young man preferably experienced water flooding for independent oil company, location North Texas. State experience fully, salary expected. Box E-350, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: Graduate petroleum engineer with approximately two years West Texas field experience for work with aggressive independent organization. State brief outline personal history, experience, and salary expected. Enclose recent photograph. Box E-354, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATIONS WANTED

GEOLOGIST 4 years foreign experience in subsurface exploration and development. Available immediately. Box E-339, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPERIENCED Production and Drilling Supt. on both Rotary and Cable Tools. Deep and Shallow wells, work over and completion, Material, Equipment, routine office duties. 39 years of age, Best reference. Box E-234, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPERIENCED, practical man—Age 62. Thirty years cable tool driller, 15 years tool pusher, work over and Production Superintendent. Would like to tie in with Independent Oil Company who needs a man to work over and build up run down production. Box E-347, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOPHYSICIST desires connection with oil company exploration department in southwest. Fourteen years experience with contract seismograph company includes computing, interpretation, crew management, special supervision, research. Box E-325, The Oil and Gas Journal, Tulsa, Oklahoma.

FORMER Independent Oil Operator ten years, with legal education, plus eight years Wall Street experience, desires connection raise funds exploratory well drilling from excess profits taxpayers. Box D-938, The Oil and Gas Journal, Tulsa, Oklahoma.

ATTENTION: Well established oil well drilling contractor desires to manage and supervise individuals', groups', small or medium-sized oil companies' drilling, production and operating problems in Central and Western Texas, and New Mexico. Personal interview by appointment is desired. Makin Drilling Company, Box No 131, Ph. No. 131, Hobbs, New Mexico.

CHEMICAL ENGINEER: M. S. Degree Economics, desires domestic or foreign position as assistant to management of oil or chemical company. Age 38. Thirteen years domestic and foreign experience refinery operations, petrochemical plant management, and process design for plant construction. Box E-330, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPERIENCED REFINERY Foreign Operating Superintendent — Age 37 — Successful administrator foreign staff Middle East, Latin American areas major operations. Box E-332, The Oil and Gas Journal, Tulsa, Oklahoma.

INSTRUMENT foreman with engineering ability 23 years experience in large refinery, 4 years electrican 18 years instrumentation. Trained in modern supervisory practices, job training and conference leading. Age 43. Prefers Mexico, Brazil or Peru. Box E-349, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST and Mining Engineer, Specialist with long years of experience and discovery, unknown locality for oil and all minerals-strata, desires expert work for limited time. Box E-316, The Oil and Gas Journal, Tulsa, Okla.

SITUATIONS WANTED

MECHANICAL Engineer, age 27, married, 4 years experience in design, construction, operation and maintenance of gas pipelines and compressor stations. Presently employed, desires domestic or foreign assignment with major oil or gas company. Box E-365, The Oil and Gas Journal, Tulsa, Oklahoma.

LANDMAN with good working knowledge of geology, drilling and other phases of oil production. Last 10 years have specialized in leasing and supervision of geologists in exploratory work. 43 years old. Presently employed but wish to make connection more commensurate with ability and knowledge. Excellent references. Box E-361, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: Accountant-office manager position in Oklahoma City with independent. OU grad., 34. Experienced all phases accounting. Write P. O. Box 1162, or Phone 58-5756, Oklahoma City.

THE POSITION YOU WANT: Oil industry companies are looking for men to fill every conceivable kind of position. If you didn't find the position in this column that you are looking for, use a "Situation Wanted" classified advertisement to state your qualifications. Some company is probably looking for your ability. See box heading for classified rates or write The Oil and Gas Journal.

BUSINESS OPPORTUNITIES

WANTED to buy from owner, producing oil property, preferably 1200 bbl. per day or more from either shallow or deep horizon or both. In reply please state daily production, number of producing wells, total average, potential and other essential information. Box E-327, The Oil and Gas Journal, Tulsa, Oklahoma.

ATTENTION: THOSE DESIRING TO INVEST IN OIL BUSINESS IN MID-CONTINENT AREA. High-class Geologist, associated with competent lease man and Drilling and Production Supt., desires to contact parties wishing to invest. We can furnish Geology, take leases, do title work, work out satisfactory drilling deal, drill the well and produce it. Will take interest as compensation. Box E-326, The Oil and Gas Journal, Tulsa, Oklahoma.

CONFIDENTIAL
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Complete Payroll Service
Record keeping—Reports
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Box E-358, The Oil and Gas Journal, Tulsa, Oklahoma.

WANT
N. Y. EXPORT REPRESENTATION?
Long established and well known oil well equipment manufacturer who has maintained N. Y. export office and sales personnel for many years, is now in a position to handle additional representation in New York for high quality manufacturers of oil equipment items. If you're looking for increased export business, write for further information. All replies held in strict confidence.
Box E-359, The Oil and Gas Journal, Tulsa, Oklahoma

WANTED
OIL INVESTMENT
Will buy outright or controlling interest in small oil company or oil holdings having minimum production income of $250,000. We are principals ready to invest up to $2,000,000. Best references offered and expected. Brokers protected. Write fully.
Box E-357, The Oil and Gas Journal, Tulsa, Okla.

BUSINESS OPPORTUNITIES

AGGRESSIVE subsurface geologist desires to sell to smaller company that wants to find production in southern Oklahoma—a good education and ten years' experience in Ardmore. Shall expect to grow in proportion financially, as the company grows. Box E-322, The Oil and Gas Journal, Tulsa, Oklahoma.

ROYALTIES

MONTANA ROYALTIES
Millions of acres now leased by world's major companies, with huge drilling play in prospect. For booklet describing Montana geology and oil development, write Landowners Royalty Company, Box 1228 Great Falls, Montana.

WE will buy producing or non-producing oil royalties. Standard Security Company 115 Broadway, New York 6

PRODUCING ROYALTIES
WANTED
ANY AREA
BERN SECURITIES CO., INC.
111 Broadway New York 6, N.Y.
WOrth 4-7546

LEASE AND DRILLING BLOCKS

IF INTERESTED in leasing California Claims in San Bernardine Base and Meridian, Township 12 S. Range 16 E. Write C. W. Deming, Box 1874, Tulsa, Okla. Box 320, Waycross, Ga.

WANTED: Oklahoma or North Texas drilling deal with merit. Not over 4500' Give full details in first letter. Box E-355, The Oil and Gas Journal, Tulsa, Oklahoma.

BLOCK of 3600 acres in New Mexico Geological reports favorable. Correspondence invited from Parties interested in developing this acreage. Zeke Morse, 2525 South Spaulding, Los Angeles, California.

LEASES on Poplar Structure in Williston Basin. Two wells now drilling on the structure. 2720 Government acreage solid block T.27 N.-R.49 E.; 1132 acres Government checkerboard in T. 27 N.-Rgs 49, 50, 51 E. $25 per acre and 2½% override. Approximately 1,100 acres checkerboard North of Murphy and Carter units. Twps. 30, 31 N.—Rgs 50, 51 E. $20 per acre and 2½% override. Subject to previous sale. Box E-364, The Oil and Gas Journal, Tulsa, Oklahoma

WATER FLOOD PROPERTY AVAILABLE 250 acres, full ⅞ leases, North Central Texas—800' to 1,000' deep. Sand production. 11 wells now producing. Estimated 20 proven undrilled locations. Ample supply salt water available from shallow sand on property. Pipe line connection—Electrically operated. Box E-360, The Oil & Gas Journal, Tulsa, Oklahoma.

WANTED TO DRILL IMMEDIATELY
A Lease That Is Off-Set to Production.
Submit full details to
NELSON B. CRAMER
2831 East Ocean Boulevard
Long Beach 3, California

DRILLING DEALS — WEST TEXAS
We are in position to offer drilling deals on good geology to independents and companies. Will furnish complete data upon request. Reply:
Box E-333, The Oil and Gas Journal, Tulsa, Oklahoma.

LEASES ROYALTIES
Producing and Nonproducing
Bought and Sold—Any Area
Inquiries Invited
B. D. BUCKLEY
6635 Delmar Ave., St. Louis 5, Mo.

LEASE AND DRILLING BLOCKS

FOR SALE: Federal and State Oil Leases, Twp. 23 N-5E; Twp. 24 N-5E; Twp. 21 N-5W; Twp. 17N-3W; Twp. 15N-1E; New Mexico P. M. About 255 acres. 10220 Kilarney, Dallas, Texas.

EXPERIENCED, retired Oil Field Superintendent will help finance, drill and promote shallow leases. Box E-348, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE: Oil and Gas Leases adjoining producing leases, also wildcat leases drilling propositions and small producing properties; all in shallow territory. W. F. Harley, Bowling Green, Ky.

WANTED: Will purchase acreage to support wildcats in Kansas, Colorado, and Nebraska and conduct drilling deals western Kansas and Julesburg Basin area. Submit details to Box E-296, The Oil and Gas Journal, Tulsa, Oklahoma.

WILL pay cash instantly for leases (large blocks), royalties, mineral deeds, production. Write fully—P. O. Box 2153, Denver, Colorado.

FOR LEASE: The west 80 acres of the northwest ¼ of Section 21 T. 13 R. 34 in Northwest Lea County N. Mexico. D. H. McDaniel, 3215 Fairway Drive, La Mesa, California.

LEGAL BLANKS

BURKHART LEGAL BLANKS since 1908. Oil-Gas (all states). Business, Real Estate, Legal Forms, Leases, Revised With Government Regulations. Commercial Printing. Catalog and Samples on request. Burkhart Printing & Stationery Company, 115 South Cincinnati, Tulsa 3, Oklahoma

FOR SALE—MAPS

NORTH DAKOTA MAPS—Base Map of North Dakota: County outline, Township and Range, location of wells and Operators name with total depths. Oil and Gas Fields. 1" = 8 miles. Price $5.00. COUNTY MAPS: Fee ownership and lease with expiration dates. Scale 1" = 4,000 Ft. Northwest Mapping Co., 1171½ Fourth St., Bismarck, North Dakota.

BOOKS FOR SALE

OIL And GAS LEASING ON THE PUBLIC DOMAIN

(By Lewis Edwin Hoffman)

Federal laws, forms, regulations and practices **Each $7.00**

GOWER FEDERAL SERVICE

321 First National Bank Bldg.
Denver, Colorado

EQUIPMENT MEN

(Continued from page 384)

Merla Names Shackelford, Warren to New Sales Posts

Merla Tool Corp., Dallas, has named Robert R. Shackelford as district sales engineer for Oklahoma with headquarters in Oklahoma City. He was formerly with Welex Jet Services as field salesman in the Oklahoma area.

Robert C. Warren, Jr., has also been appointed as sales engineer in the East Texas and northern Louisiana area with temporary headquarters in Shreveport. Before joining Merla, Warren was associated with Continental Supply Co. in the West Texas area.

Totco Expands Service In Mid-Continent Area

H. H. (Pete) Peters, vice president of Technical Oil Tool Corp., Ltd., announced the recent addition of two service engineers in the Mid-Continent area.

Wayne L. Moore has been stationed by Totco in the Houston area. A. B. (Al) Sanders has also been employed to increase the Totco staff located at Odessa, Tex. Including these men, Totco now has six engineers under

W. L. MOORE

A. B. SANDERS

R. L. O'Rear, Gulf Coast division manager, and eight engineers under the direction of F. E. Siever, to serve the West Texas division.

A total of 23 Totco representatives are now servicing the Mid-Continent area under the general direction of E. G. McConnell.

Fleming to Do Research For Girdler Corp.

Dr. H. W. Fleming has joined the research and development department of The Girdler Corp., Louisville. He will direct the company's expanding catalyst development program.

Before his association with Girdler, Dr. Fleming was a group leader in Phillips Petroleum Co.'s research and development department.

Dresser Equipment Spudder Line Purchased by Keystone

Keystone Driller Co., a leading manufacturer of power shovels and cable drills, has purchased the complete cable-tool drilling machinery business of Dresser Equipment Co., Columbus, it was announced recently by Harold J. Ruttenberg, president of Keystone, and C. E. Ponkey, vice president of Dresser.

The purchase of this line is a part of Keystone's long-range program of modernizing its operations and expanding its own line of spudding machines. All finished machines, repair parts, and related equipment will be moved to Keystone's Beaver Falls plant where the company will manufacture the newly acquired additions to its product line.

Humphreys Is Named Board Chairman for U. S. Rubber

H. E. HUMPHREYS

H. E. Humphreys, Jr., president of United States Rubber Co., has been elected chairman of the board of directors. He will continue as president.

Humphreys will succeed Herbert E. Smith, chairman and former president, recently retired. Smith will continue as a director and member of the finance committee.

The board also elected John W. McGovern, vice president and general manager of the tire division, a member of the executive committee. Howard N. Hawkes, assistant general manager of the tire division, was elected a vice president and appointed by Humphreys as general manager of the tire division to succeed McGovern.

Humphreys joined United States Rubber as a vice president, director, and member of the finance and of the executive committees in 1938. He was elected vice chairman of the executive committee in 1942, and he was made president and chairman of the executive committee in January 1949.

Jacobson Elected President Of Union Malleable

S. I. JACOBSON

Union Malleable Manufacturing Co., Ashland, Ohio, recently announced the election of Sol J. Jacobson to the office of president of the parent company and its subsidiaries, The Ashland Malleable Iron Co. and The Union Brass & Copper Co.

Jacobson, who has been vice president for the past several years, succeeds Jack Jacobson, founder and president of Union Malleable, recently deceased.

National Supply Opens New Illinois Store

National Supply Co. has opened a store in Robinson, Ill., which will be under the management of Wayne A. Brown, transferred from the company's Crossville, Ill., store. Field representative for the area will be Pearl A. (Steamer) White, who was transferred from Lawrenceville, Ill., territory. He has been with National since 1941.

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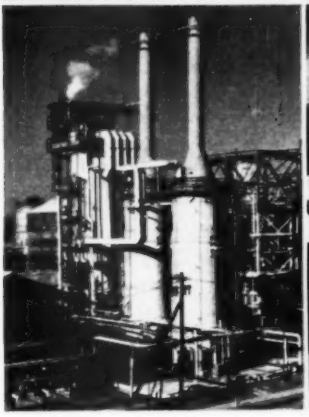
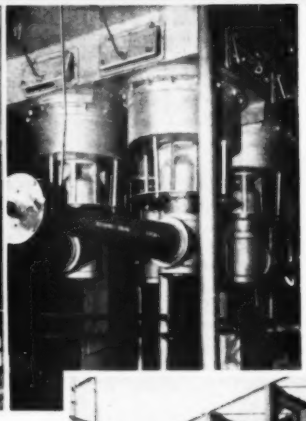


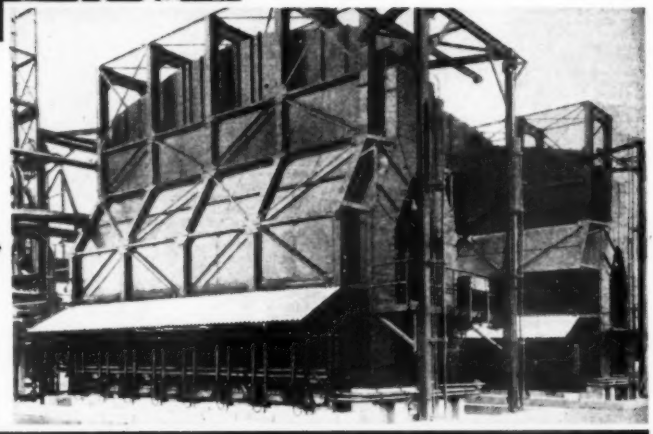


Large Petro-Chem heater equipped with National Airoil Combination gas and oil Tandem Block Combustion Units for high heat liberation with either gas or oil fuel.

Close-up of the burners while in operation and after three months without shutdown.

Showing two of numerous large, modern McKee Co. crude furnaces of the center wall up-draft type. Each furnace is equipped with sixteen National Airoil flat flame oil burner units for uniform heating of wall tubes. The burners fire directly upward and parallel with the bridge or center wall.

National Airoil Burner Co. are pioneers in successfully upfiring oil and combination oil and gas in stills, boilers, heaters and superheaters.



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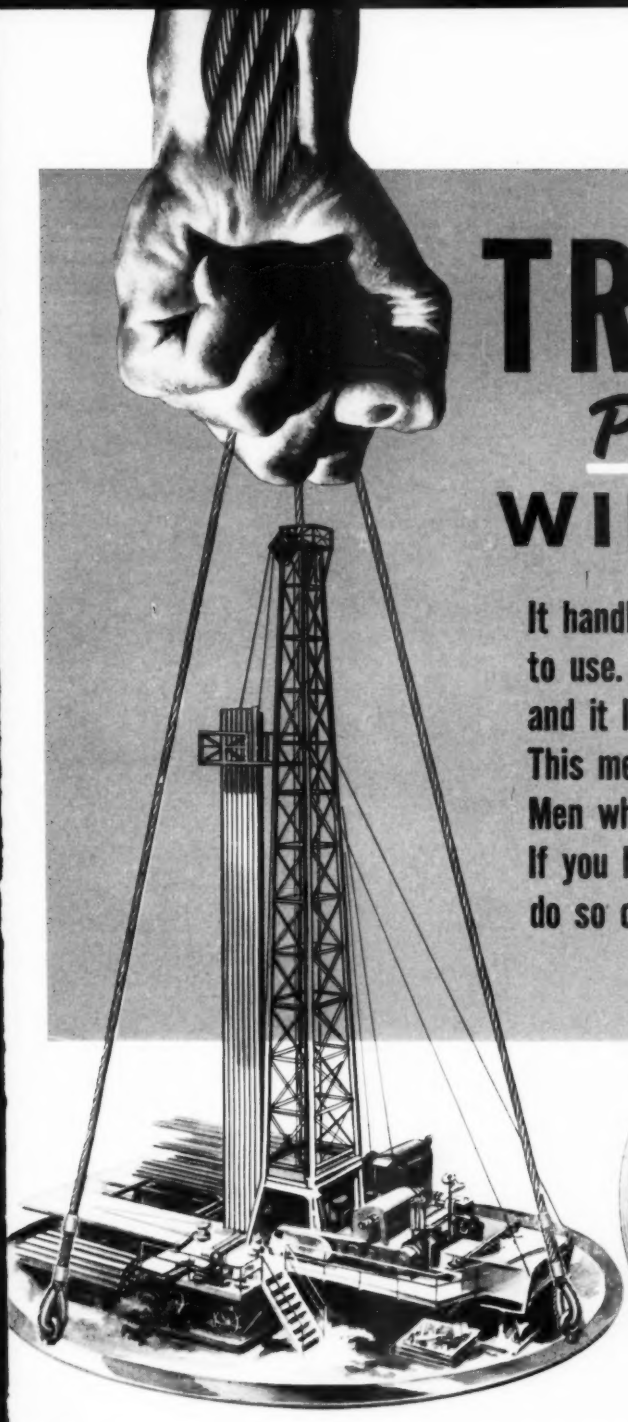
INDUSTRIAL OIL BURNERS, GAS BURNERS, FURNACE EQUIPMENT



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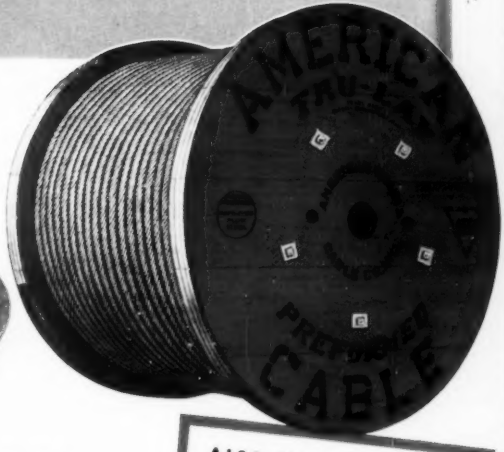

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